# INTERMEDIATE LEVEL MAINTENANCE MANUAL

# FOR THE

# WJ-8712 DIGITAL HF RECEIVER

WATKINS-JOHNSON

# WJ-8712 DIGITAL HF RECEIVER

## INTERMEDIATE LEVEL MAINTENANCE MANUAL

## REVISION RECORD

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| A | Initial issue. | 1/93 |

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## GENERAL DESCRIPTION

# SECTION I

# GENERAL DESCRIPTION

## 1.1 ELECTRICAL CHARACTERISTICS

The WJ-8712 Digital HF Receiver is a remote controlled, synthesized receiver capable of continuous 1 Hz tuning resolution over the frequency range of 5 kHz to 30.0 MHz. Available detection modes are AM, FM, CW, ISB, USB, and LSB. Selectable IF bandwidths are: 0.3, 1.0, 3.2, 6.0, and 16.0 kHz. Manual or automatic gain control (AGC) modes are selectable. In CW detection mode, beat frequency oscillator (BFO) and passband tuning capabilities are available. The BFO is adjustable over a ±8000 Hz range in 10 Hz steps. Passband tuning, which is an operator aid that facilitates simultaneous adjustments of tuned frequency and BFO, is adjustable over a ±2000 Hz range.

The receiver's squelch threshold can be set to any value from 0 to -135 dBm or can be turned off. For use with HF transmitters, audio signals can be muted via the presence of an external control signal input at the receiver's rear panel.

In addition to fixed frequency tuning, the WJ-8712 provides a flexible scanning capability. Three scan types are available: channel scan, frequency-to-frequency scan (F1 to F2), and frequency-to-frequency scan with lockouts. In channel scan mode, the receiver steps through a sequence of up to 100 user-programmable memory channels. Receiver parameters stored in each channel include frequency, IF bandwidth, detection mode, gain control, and squelch threshold. Prior to initiating the channel scan, the operator may select a specific range of channels to scan through. Individual channels within the range can be identified for the receiver to skip over during the scan. In both frequency-to-frequency scan modes, the receiver monitors frequencies between programmed start and stop frequencies according to a selected step size between 1 Hz and 25 kHz. For all scan modes, the receiver automatically stops when a signal is acquired that breaks the squelch threshold level. The duration of time the receiver holds on a signal before resuming scan (dwell time) is operator-selectable between 0.5 and 20 seconds. An infinite dwell time can also be selected. A built-in-test (BITE) function is available which can be used to verify equipment performance.

The WJ-8712 is operated remotely via one of two selectable serial interfaces. With the exception of audio output level and remote control mode selection, all receiver parameters are controllable and accessible via an RS-232C remote interface. A Carrier Sense/Multiple Access with Collision Detection (CSMA) interface with limited instruction set may be enabled, in lieu of RS-232C, to allow the WJ-8712 to be controlled using an alternate command protocol. A different set of remote control commands is utilized with each of the two interfaces. Selection of the active interface is made via an internal switch setting. Additionally, a built-in-test (BITE) function can be initiated from the RS-232C interface as well as status reporting.

The WJ-8712's internal power supply accepts 97-253 VAC, 47-440 Hz line power as its power source. The unit's internal power supply automatically adjusts to the input power, providing it is within the acceptable limits. Total power consumption is less than 30 watts.

Refer to Table 1-1 for a complete listing of WJ-8712 Digital HF Receiver specifications.

**Table 1-1. WJ-8712 Digital HF Receiver Specifications**

| | |
|---|---|
| Frequency Range | 5 kHz to 30 MHz (Tunable to 0 Hz, degraded performance below 500 kHz) |
| Tuning Resolution | 1 Hz |
| Internal Reference Stability | Better than 0.7 PPM (0 to 50°C), Standard. Better than 0.1 PPM (0 to 50°C), with WJ-871Y/REF Option |
| External Reference Frequency | Accepts 1, 2, 5 or 10 MHz (±1 PPM or better, 200 mV p-p into high impedance load). Automatically switches to external reference upon application of signal |
| Synthesizer Lock Time | Less than 10 msec typical |
| Antenna Input | |
| Impedance | 50 ohms, nominal |
| VSWR | 2:1 maximum at receiver's tuned frequency |
| Maximum Input Signal | +30 dBm |
| Connector | BNC female |
| Third Order Intercept Point | +30 dBm typical, +25 dBm minimum (for signals separated by 50 kHz minimum) |
| Second Order Intercept Point | +60 dBm typical |
| Noise Figure | 14 dB maximum (11 dB maximum with preamplifier engaged) |
| Detection modes | AM, FM, CW, USB, LSB and ISB (Consult factory for additional demodulation modes) |

Sensitivity (500 kHz - 30 MHz)

| Modulation | IF BW | S+N/N Min | Without Preamp Min dBm/μV |
|---|---|---|---|
| AM (50% mod. at 400 Hz) | 6.0 kHz | 10 dB | -103/(1.58) |
| FM (4.8 kHz dev. 400 Hz mod) | 16.0 kHz | 17 dB (SINAD) | -99/(2.50) |
| USB/LSB/ISB | 3.2 kHz | 10 dB | -112/(0.56) |
| CW | 0.3 kHz | 16 dB | -116/(0.35) |

CW Sensitivity, 5 kHz - 500 kHz, without Preamp (0.3 kHz IF Bandwidth)

| | |
|---|---|
| 50 kHz - 500 kHz | -113 dBm (0.5 μV) typical for 16 dB S+N/N |
| 20 kHz - 50 kHz | -105 dBm (1.27μV) typical for 16 dB S+N/N |
| 5 kHz - 20 kHz | -78 dBm (28 μV) typical for 16 dB S+N/N |

IF Bandwidths

| 3 dB Bandwidth | (Maximum) Shape Factor (3/60 dB) | (Typical) Group Delay Variation (100% of 3 dB BW) |
|---|---|---|
| 0.3 kHz | 1.35:1 maximum | 50 μS |
| 1.0 kHz | 1.40:1 maximum | 30 μS |
| 3.2 kHz | 1.25:1 maximum | 30 μS |
| 6.0 kHz | 1.25:1 maximum | 40 μS |
| 16.0 kHz | 1.25:1 maximum | 60 μS |
| USB/LSB/ISB | 1.25:1 maximum | 30 μS |

(Consult factory for alternate or additional IF bandwidths)

**Table 1-1. WJ-8712 Digital HF Receiver Specifications** (Continued)

| | |
|---|---|
| Line Audio Outputs | |
| Number of Outputs | Two center-tapped, balanced outputs. For ISB mode, USB and LSB on separate outputs. For all other modes, audio signal is common to both outputs. |
| Output Level | 0 dBm nominal into 600-ohm load |
| Connector Type | Screw Terminals |
| Speaker Output | |
| Number of Outputs | One output. For ISB mode, USB and LSB can be selected individually or combined. (Internal Speaker optional) |
| Bandwidth | 100 Hz to 13 kHz |
| Output Level | Adjustable up to 1 watt into 8-ohm load |
| Total Harmonic Distortion | Less than 3% at 1 watt |
| Connector Type | Screw terminals |
| Headphone Output | |
| Number of Outputs | Two unbalanced outputs. For ISB mode, one output contains USB (left channel), the other contains LSB (right channel). In all other modes, the audio signal is common to both outputs |
| Output Level | Adjustable up to 10 mW into 600-ohm load |
| Connector Type | Standard 1/4" stereo jack |
| Remote Control | RS-232 or CSMA; selectable by internal switch |
| RS-232 | Full duplex, 3-wire serial interface; rear panel 25-pin female D-shell connector |
| CSMA | Carrier Sense/Multiple Aecess with Collision Detection; half duplex; rear panel miniature phone jack |
| Baud Rates (Both Interfaces) | 75, 150, 300, 600, 1200, 2400, 4800 and 9600; selectable by internal switches. |
| Environmental | |
| MIL-STD-810 Test Method | A. Low Temperature Test Method 502.2<br>B. High Temperature Test Method 501.2<br>C. Humidity Test Method 507.2<br>D. Altitude Test Method 500.2<br>E. Vibration Test Method 514.3<br>F. Shock Test Method 516.3 |
| Operating Temperature | 0°C to +50°C |
| Storage Temperature | -40°C to +70°C |
| Humidity | 10 Cyclic days (240 Hrs.) Procedure III for Continuous Exposure to 95% RH. |
| Altitude | 50,000 ft. non-operating<br>24,000 ft. operating |

**Table 1-1. WJ-8712 Digital HF Receiver Specifications** (Continued)

| | |
|---|---|
| Line Audio Outputs | |
| Number of Outputs | Two center-tapped, balanced outputs. For ISB mode, USB and LSB on separate outputs. For all other modes, audio signal is common to both outputs. |
| Output Level | 0 dBm nominal into 600-ohm load |
| Connector Type | Screw Terminals |
| Speaker Output | |
| Number of Outputs | One output. For ISB mode, USB and LSB can be selected individually or combined. (Internal Speaker optional) |
| Bandwidth | 100 Hz to 13 kHz |
| Output Level | Adjustable up to 1 watt into 8-ohm load |
| Total Harmonic Distortion | Less than 3% at 1 watt |
| Connector Type | Screw terminals |
| Headphone Output | |
| Number of Outputs | Two unbalanced outputs. For ISB mode, one output contains USB (left channel), the other contains LSB (right channel). In all other modes, the audio signal is common to both outputs |
| Output Level | Adjustable up to 10 mW into 600-ohm load |
| Connector Type | Standard 1/4" stereo jack |
| Remote Control | RS-232 or CSMA; selectable by internal switch |
| RS-232 | Full duplex, 3-wire serial interface; rear panel 25-pin female D-shell connector |
| CSMA | Carrier Sense/Multiple Aecess with Collision Detection; half duplex; rear panel miniature phone jack |
| Baud Rates (Both Interfaces) | 75, 150, 300, 600, 1200, 2400, 4800 and 9600; selectable by internal switches. |
| Environmental | |
| MIL-STD-810 Test Method | A. Low Temperature Test Method 502.2<br>B. High Temperature Test Method 501.2<br>C. Humidity Test Method 507.2<br>D. Altitude Test Method 500.2<br>E. Vibration Test Method 514.3<br>F. Shock Test Method 516.3 |
| Operating Temperature | 0°C to +50°C |
| Storage Temperature | -40°C to +70°C |
| Humidity | 10 Cyclic days (240 Hrs.) Procedure III for Continuous Exposure to 95% RH. |
| Altitude | 50,000 ft. non-operating<br>24,000 ft. operating |

**Table 1-1. WJ-8712 Digital HF Receiver Specifications** (Continued)

| | |
|---|---|
| Vibration (1) ..... | A. Basic Transportation (Secure Cargo) Category 1 - Random Vibration 1.04G's Non-Operating - 2 Hours.<br>B. Ground Mobile (Wheeled or Tracked Vehicle) Category 8 - Random Vibration 6.0G's Operating 15 Minutes.<br>C. Marine (Shipboard) Vessel not specified Category 9 - Random Vibration 1.0G's Operating 2 Hours.<br>D. Environmental Stress - NAVMAT-P-9492 Random Vibration 6.0G's Operating 15 minutes for Design Qualification. 3.0G's Non-Operating 10 minutes for Production Screening (ESS). |
| Shock (1) ..... | Bench Handling (Field Service) 8 drops total onto a horizontal hard wooden surface - operating. |
| MTBF ..... | In excess of 13,000 hrs. Estimated in accordance with MIL-HDBK 217E for Ground Fixed, +40°C environment. |
| Power Requirements ..... | 97 to 253 VAC, 47 to 440 Hz |
| Power Consumption ..... | 30 watts typical with options |
| Dimensions ..... | 3.5" x 8.25" x 20" (8.89 x 20.96 x 50.80 cm) (excluding connectors and controls) |
| Weight ..... | Less than 12 pounds (5.5 kG) |

(1) All vibration and shock testing was accomplished without the use of isolation mounts. Unless otherwise specified, the vertical (Z) mounting axis was the direction of applied force.

## 1.2 MECHANICAL CHARACTERISTICS

The WJ-8712 is designed in a half-rack enclosure (19-inch rack), occupying 3.5 inches of vertical rack space and extending 20 inches in depth. Either two units can be mounted side-by-side (standard configuration), or an optional blank rack (WJ-8712/BR) can be ordered to mount a single unit in the 19-inch rack. A #10 threaded grounding stud is located on the rear panel for grounding the receiver in the rack. See **paragraph 2.2.1** for rack mounting instructions.

The blank front panel only contains the POWER switch, a PHONES jack with the associated volume control, and a CONTROL INTERFACE multipin connector. All input and output connectors (except for the PHONES jack and the CONTROL INTERFACE connector) are located on the rear panel. Connector types used are BNC, multipin, mini-phones, 1/4-inch stereo headphones jack, and a 13-terminal audio terminal block.

The top and bottom covers and main chassis are constructed of aluminum. Removal of the covers provides access to all internal circuitry including the following three

major assemblies: the Type 797012-1 Digital Assembly, the Type 797006-1 RF Tuner Assembly, and the Type 383076-1 Power Interface Assembly.

## 1.3 OVERALL FUNCTIONAL DESCRIPTION

Functionally, the WJ-8712 can be divided into four subsystems: the RF Subsystem, the Digital Signal Processing (DSP) Subsystem, the IF/Audio Output Subsystem, and the Control Subsystem (see **Figure 1-1**).

The 5 kHz to 30.0 MHz RF antenna input signal is first applied to the RF subsystem. Here the RF signal is mixed with three local oscillator (LO) signals to produce an intermediate frequency (3rd IF) centered at 25 kHz. The 1st LO tunes from 40.455 to 70.455 MHz in 1 kHz steps to produce a 1st IF of 40.455 MHz. The 1st IF is mixed with the 2nd LO, which is fixed at 40 MHz, to produce a 2nd IF of 455 kHz. The 2nd LO is also routed to the DSP Subsystem for use as a system clock for the DSP processors.

The 2nd IF signal is then split. One path of the signal is routed to the rear panel SMO connector as the signal monitor output. The other path of the 2nd IF is routed to a mixer where it is mixed with the 3rd LO. The 3rd LO signal is fixed at 430 kHz to produce a 3rd IF of 25 kHz. The 3rd LO is also routed to the IF/Audio Output Subsystem to be used for final IF conversion.

The timing and synchronization of the LO's are driven by a 10 MHz reference signal. This reference can be generated by an internal 10 MHz clock or can be driven by an external reference input of 1, 2, 5, or 10 MHz.

The DSP Subsystem performs the majority of the signal processing functions within the receiver. This subsystem is comprised of a 16-bit analog-to-digital (A/D) converter, a 24-bit fixed-point Digital Signal Processor (DSP), and associated static random-access memory (SRAM).

The 3rd IF signal, provided by the RF Subsystem, is sampled by the A/D converter to 16 bits of resolution at an output sampling rate of 100 kHz. This digitized output signal of the A/D is then applied to the DSP which performs the following functions to the sampled waveform:

- Fine tuning (in 1 Hz steps) in accordance with the operator selected tuned frequency,
- IF filtering in accordance with the operator-selected IF bandwidth,
- Gain control (AGC Fast, AGC Slow or Manual),
- Determination of the received signal strength,
- Signal demodulation in accordance with the operator-selected detection mode, and BFO tuning resolution.
- Noise blanking, and
- Generation of a multiplexed digital serial data stream containing two demodulated audio channels and a post filtered IF signal for analog reconstruction by the IF/Audio Output Subsystem.

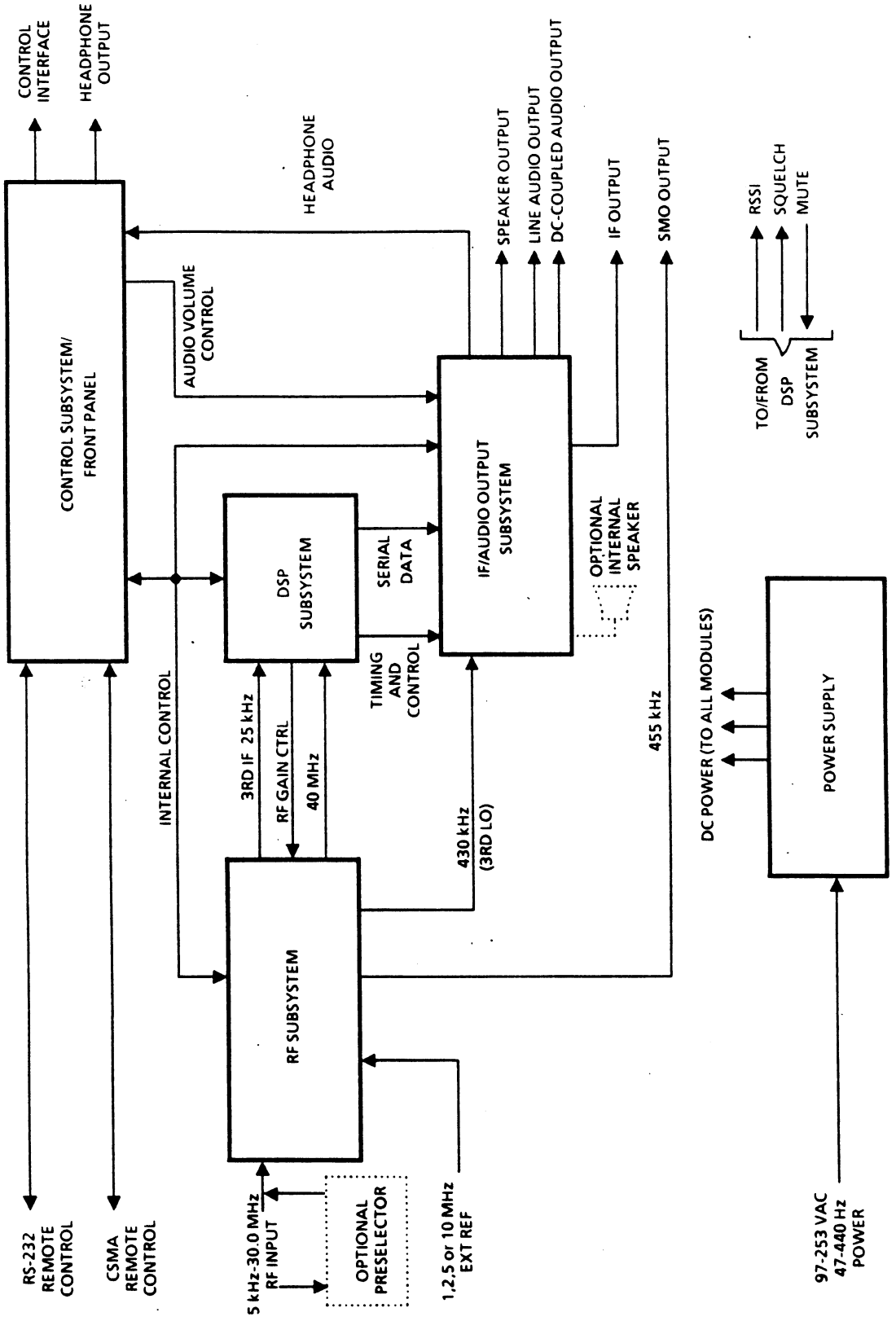



**Figure 1-1. WJ-8712 Overall Functional Block Diagram**

The IF/Audio Output Subsystem takes the multiplexed IF and audio serial data received from the DSP Subsystem and reconstructs it into two separate audio signals and one filtered IF signal. The two analog audio signals are processed in this subsystem to provide the following outputs:

- Two-channel (stereo) headphone outputs to the front panel PHONES jack,
- An 8-ohm speaker output that consists of one or both audio channels, and
- Two balanced line outputs with a fixed nominal output level of 0 dBm into 600 ohms.

Following analog reconstruction, the filtered IF signal is converted up to 455 kHz by a sample of the 430 kHz 3rd LO supplied by the RF Subsystem. The up-converted IF signal is passed through a bandpass roofing filter to remove unwanted mixer products, is buffered, and is then routed to the rear panel as the IF Output.

The Control Subsystem consists of a control microprocessor and its associated memory, an RS-232 interface, a Carrier Sense/Multiple Access (CSMA) interface, and the front panel CONTROL INTERFACE connector test port. The control microprocessor monitors remote commands (via the remote interfaces), processes the instructions, and sends internal control data to the other subsystem in the receiver to update hardware. The control microprocessor also monitors the action of the hardware and appropriately updates and transmits remote responses (when queried) over the remote interface.

The Power Supply section of the receiver generates the dc supply voltages required by the subsystems of the receiver. The power supply is powered by the 97-253 VAC 47-440 Hz input connected at the rear panel POWER connector.

## 1.4 EQUIPMENT SUPPLIED

Equipment supplied with the WJ-8712 consists of an Installation and Operation Manual, and a six-foot AC power cord.

## 1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED

To obtain full utilization of the receiver, equipment from the following list should be selected:

- HF Antenna, 50 ohm
- Headphones, 600 ohms
- Line audio monitoring equipment
- Signal Monitoring equipment
- Remote Controller, CSMA or RS-232C compatible

## 1.6 RECEIVER OPTIONS

### 1.6.1 WJ-871Y/REF REFERENCE GENERATOR OPTION

This factory-installed option improves the WJ-8712 internal reference generator stability from better than 0.7 ppm to better than 0.1 ppm. Refer to **Appendix A** for further information on the WJ-871Y/REF option.

### 1.6.2 WJ-8712/PRE SUBOCTAVE PRESELECTOR OPTION

This option provides band filtering of the incoming RF spectrum between 0 and 30 MHz for improved second and third order intercept point performance. The WJ-8712/PRE option uses eleven separate filter bands, each covering a segment of the overall range. The appropriate filter is automatically selected as the receiver is tuned. Refer to **Appendix B** for further information on the WJ-8712/PRE option.

### 1.6.3 WJ-8712/DSO DIGITAL SIGNAL OUTPUT OPTION

This option provides digitized time samples (A/D output), IF, and audio in a high speed serial format. Digital I and Q outputs can be made available.

### 1.6.4 WJ-8712/BR BLANK RACK OPTION

This option allows for mounting of a single WJ-8712 receiver in a standard 19-inch rack. Two side by side mounted WJ-8712 receivers in a standard 19-inch rack is the standard configuration.

### 1.6.5 WJ-8712/FP FRONT PANEL OPTION

This option allows a microprocessor-controlled front panel to be plugged into the blank front panel to allow user-friendly local control and BITE functions. See **Appendix C.**

## 1.7 WJ-8712 SOFTWARE VERSION RELEASE HISTORY

To ensure efficient receiver operations, the WJ-8712 uses two microprocessors, each running its own software code. The digital microprocessor (A2U1) runs the internal control code, and the digital signal processor (A2U37) runs the digital signal processing (DSP) code.

### 1.7.1 WJ-8712 INTERNAL CONTROL SOFTWARE RELEASE HISTORY

The WJ-8712 internal control software is contained in EPROM A2U12. The original internal control software, version 1.00, was released May 23, 1991.

Version 1.10 was never released.

Version 1.20, released December 20, 1991, added the following RS-232C remote commands and queries: AGC, AGC?, BFO, BFO?, BWS, BWS?, CDE?, CTL, CTL?, DET, DET?, FRQ, FRQ?, LDE?, REF?, RFG, RFG?, RFP, RFP?, SGV?, SQL, SQL?, *CLS, *ESE, *ESE?, *ESR?, *RST, *SRE, *SRE?, *STB?, and *TST?. This release also allowed service request handling on the RS-232C interface. This release improved BITE by testing the following receiver areas: the DSP circuitry, the RF signal path, and the audio signal path. This release set the default AGC value to FAST AGC, and the IFBW default value to 6 kHz. This release also temporarily mutes the receiver audio when changing the RF input path. When changing detection modes from a non-SSB (AM, FM, CW) detection mode to a SSB detection mode (LSB, USB, ISB), this release stores the non-SSB IFBW value and selects the 3.2 kHz IFBW. When the detection mode is changed back to a non-SSB detection mode, the previously stored non-SSB IFBW returns. This release disallowed the preamplifier RF input path when tuned below 500 kHz. This release added the selected RF input path to the variables stored in a memory channel.

Version 1.21, released February 25, 1992, improved BITE and changed the default BFO value from 0 kHz to +1 kHz.

Version 1.30, released May 27, 1992, added the following RS-232C remote commands and queries: ADV, BLK, BLK?, CHA, CHA?, CHB, CHB?, CHI, CHS, CLM, ENA, EXE, FRA, FRA?, FRB, FRB?, IDN?, INC, INC?, LCK, LRN?, MUT?, OPC, OPC?, OPR?, PBT, PBT?, RCL?, RLK?, SCF, SCF?, SCS?, SDW, SDW?, SLM?, SPK, STO, SUS, and ULK.

Version 1.40, released June 25, 1992, supported the WJ-8712/PRE preselector option, allowed interrupts during BITE, and shortened the lockout stored message to one second.

Version 1.41, released July 23, 1992, added the receiver status register to the WJ-8712 status structure. This additional register allows the receiver to generate service requests (SRQ) for reporting signal found and end-of-scan. This release also added the following RS-232C remote commands: *RSE, *RSE?, and *RSR?.

### 1.7.2 WJ-8712 DSP SOFTWARE RELEASE HISTORY

The WJ-8712 DSP software is stored in EPROM A2U56. The original version 1.00, released May 29, 1991.

Version 1.10 was never released.

Version 1.20, released December 17, 1991, increased the EPROM address space from 8000H-FFFFH to 4000H-FFFFH. This release runs properly on the type 797012-1 Digital Board and may not run properly on earlier digital boards.

# SECTION II

# INSTALLATION

# SECTION II

# INSTALLATION

## 2.1 UNPACKING AND INSPECTION

Watkins-Johnson Company ships the WJ-8712 and its accessories in a cardboard shipping container, designed specifically for its dimensions and weight. After unpacking the equipment, retain the shipping container and packing material until the equipment has been thoroughly inspected and it is ensured that reshipment is not necessary. Perform the following initial inspection:

1. Carefully inspect the outside of the shipping container for discoloring, stains, charring, or other signs of exposure to excessive heat, moisture, or liquid chemicals. Check for any signs of excessive shock or careless handling.
2. Remove all equipment and accessories from the shipping container. If any items are missing, contact the factory or your Watkins-Johnson representative.
3. Remove and retain the white 5x6 inch PRODUCT DISCREPANCY REPORT card. This card should be used if reshipment of the equipment is required. It also contains important warranty adjustment information.
4. Carefully inspect the equipment for dents, scratches, damaged or loose pushbuttons or knobs, or any other signs of physical abuse or careless handling during shipment.

If damage is found, forward an immediate request to the delivering carrier to perform an inspection and prepare a concealed-damage report. Do not destroy any packing material until it has been examined by an agent of the carrier. Concurrently, report the nature and extent of damage to the Watkins-Johnson Company, giving equipment serial numbers, so that necessary action can be taken. Under U.S. shipping regulations, claims for damage must be collected by the consignee; do not return the equipment to the Watkins-Johnson Company until a claim for damages has been established.

**NOTE**

The WJ-8712 does not include conformal coated parts as a standard addition. The WJ-8712/ENV Digital HF Receiver parts are conformal coated. Replacement parts that are conformal coated will function properly in either receiver. Refer to **Section VIII** for the main chassis replacement parts list.

## 2.2 INSTALLATION

### 2.2.1 RACK MOUNTING

The WJ-8712 Digital HF Receiver is packaged in a 3.5" x 8.25" x 20" half rack enclosure, and can be mounted in a standard 19-inch equipment rack through the use of the WJ-8712/BR (Blank Rack) option. The standard configuration calls for the side by side mounting of two WJ-8712 receivers in a standard 19-inch equipment rack. The use of Jonathan Type 110QD-20-2 chassis slides are recommended for rack mounting the WJ-8712 receivers in the standard configuration.

Supporting loads up to 120 pounds, these slides mount easily into bracketed equipment racks using machined bar nuts. **Figure 2-1** illustrates installation of the chassis slides to an equipment rack, with special attention given to bracket hole spacing.

**CAUTION**

Do not use screws longer than 5/16 inch in slide mounting holes of the WJ-8712. Damage may result to the unit.

Each of the Type 110QD-20-2 chassis slides are comprised of two functional pieces: a chassis section for mounting to the unit and a cabinet section for mounting to the equipment rack. Three 10-32 X 5/16 pan head screws are used to install each chassis section to a side panel of one WJ-8712. After both chassis sections have been securely tightened to a WJ-8712 receiver the cabinet sections are to be installed within the equipment rack. The WJ-8712 occupies 3.5 inches of vertical rack space. Four holes are used to secure the cabinet section of the slide to the equipment rack. Two outer holes are used to secure the unit's front panel to the equipment rack. Slide locks permit quick disconnect of the chassis section of the slides from the cabinet sections for equipment removal. A #10 threaded grounding stud is located on the rear panel for grounding the receiver in the equipment rack. See **paragraph 2.2.4.11.**

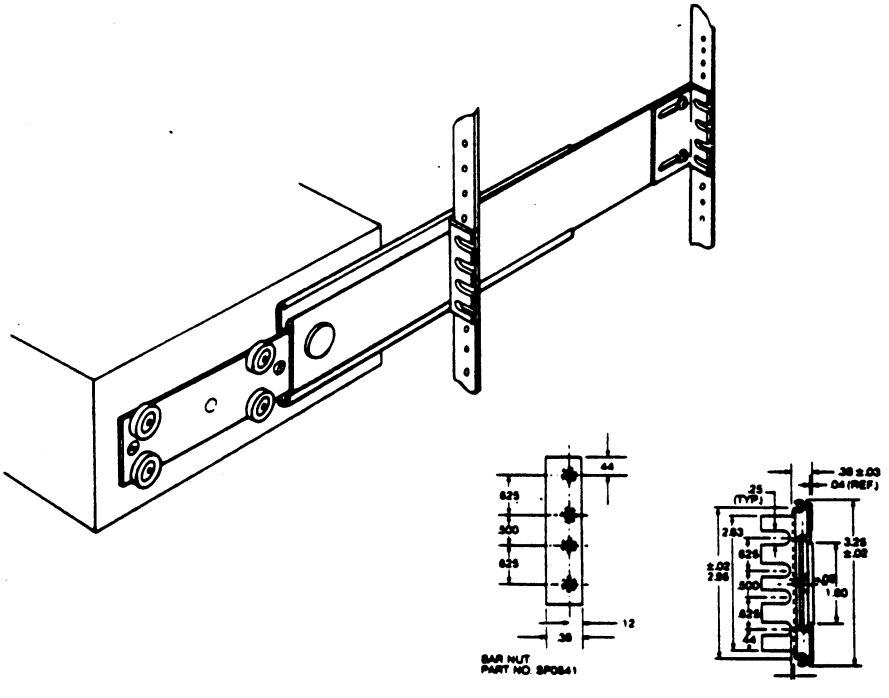


**Figure 2-1. Installation of Jonathan Type 110QD-20-2 Slide Mounts**

### 2.2.2 POWER REQUIREMENTS

The WJ-8712 requires an input voltage of 97-253 VAC at 47 to 440 Hz for operation. The receiver's internal power supply circuitry automatically adjusts to the power input applied (providing it is within the specified range). Therefore, no manual switching of power source voltage selection is required. The six-foot line power cord supplied with the receiver connects to the three-prong POWER connector (FL1J1) located on the rear panel. The WJ-8712 requires approximately 30 watts for operation.

A 1 amp, slo-blo fuse (F1) is provided and located on the rear panel of the receiver (see **Figure 2-2**). This type fuse is to be used for operation anywhere in the VAC range.

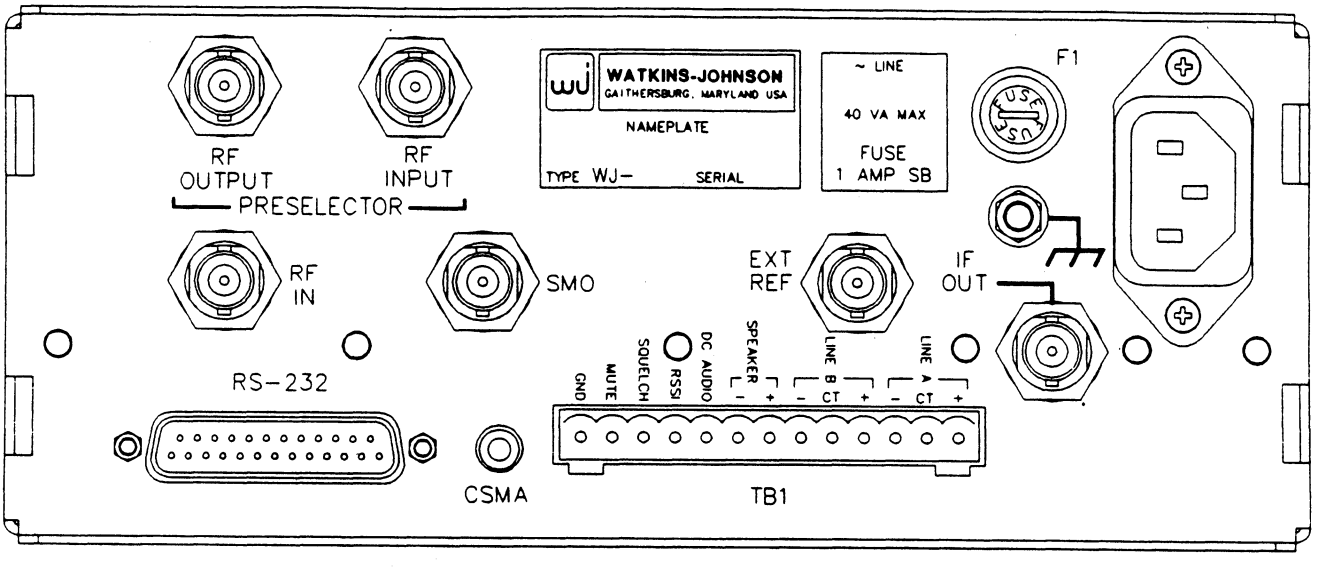



**Figure 2-2. WJ-8712 Rear Panel**

To replace the fuse, first turn off the receiver and disconnect the power cord from the rear panel. Remove the fuse by rotating it counterclockwise and replace with a 250 V, 1 amp, slo-blo fuse. Reinstall the fuse in its compartment and rotate it clockwise until the mechanical stop is felt. Reconnect the power cord.

### 2.2.3 CONNECTOR SIGNALS

All external connectors of the WJ-8712 are located on the rear panel, with the exception of the PHONES jack and the CONTROL INTERFACE connector which are located on the front panel. **Table 2-1** lists these connectors and provides a brief description and the reference designation for each. **Figure 2-3** shows the location of the rear panel connectors. The following paragraphs provide details of the signals resident at the connectors.

**Table 2-1. List of Connectors**

| Connector | Reference Designation | Function |
|---|---|---|
| RF IN | A3J1 | BNC female. RF input from an antenna (or from A4J2 Preselector Output, when configured with WJ-8712/PRE option). |
| SMO | A3J2 | BNC female. Signal monitor output. |
| EXT REF | A3J3 | BNC female. 1, 2, 5, or 10 MHz reference input. |
| IF OUT | A2J1 | BNC female. Post-filtered IF output. |
| CSMA | A2J2 | Mini-phone. Carrier Sense/Multiple Access (CSMA) remote interface port. |
| A2J3 | A2J3 | D-Type, 25-pin. RS-232C remote serial interface port. |
| TB1 | TB1 | Thirteen-terminal audio terminal block. Provides connection for two line audio outputs, DC-coupled audio output, speaker output, remote signal strength indication output, squelch output, and mute input. |
| POWER | FL1J1 | Three-prong male receptacle, mates with line power cord. 97-253 VAC 47-63 Hz power input. |
| PHONES | A1J1 | 1/4-inch stereo headphones jack. Headphones audio. |
| CONTROL INTERFACE | 3WJ1 | Multi-pin, 25-pin. Remote Control Interface primarily intended for use as a test port. |
| PRESELECTOR RF INPUT | A4J3 | BNC female if installed. RF input to WJ-8712/PRE option (see **Appendix B** for detail on WJ-8712/PRE option). |
| PRESELECTOR RF OUTPUT | A4J4 | BNC female if installed. Preselected RF output from WJ-8712/PRE option (see **Appendix B** for detail on WJ-8712/PRE option). |

2.2.3.1 **RF IN, Antenna Input (A3J1)** - This BNC female connector accepts the 5 kHz-30.0 MHz RF input from the antenna or the WJ-8712/PRE Preselector option (if installed). Input impedance is nominally 50 ohms.

2.2.3.2 **SMO, Signal Monitor Output (A3J2)** - The signal monitor output is a BNC female connector, which provides a sample of the 2nd intermediate frequency, centered at 455 kHz with a minimum (-6 dB) bandwidth of 30 kHz and an inverted spectrum. The nominal output impedance is 50 ohms with typically 25 dB of gain from the antenna input. This output may be used by a signal monitor or other ancillary equipment.

2.2.3.3 **EXT REF, External Reference Input (A3J3)** - This female BNC connector allows an external 1 MHz, 2 MHz, 5 MHz, or 10 MHz reference input, having a minimum level of 200 mV peak-to-peak into a high impedance load, to be used as the time base for the receiver. The WJ-8712 automatically switches to external reference operation upon sensing the external reference input signal (providing it is within the specified limits).

2.2.3.4 **IF OUT, Post-Filtered IF Output (A2J1)** - This BNC female connector provides the post-filtered IF output. The output is centered at 455 kHz with a bandwidth equal to the operator-selected IF bandwidth. The nominal output level is -20 dBm into a 50 ohm load.

2.2.3.5 **CSMA, Carrier Sense/Multiple Access Port (A2J2)** - This mini-phone connector is used as the interface port for Carrier Sense/Multiple Access (CSMA) remote operations. The connector's center conductor carries the remote data while the sleeve is ground. See **Section V** of this manual for details on the CSMA remote interface and operations.

2.2.3.6 **A2J3, RS-232C Serial Interface Port** - This D-type, 25-pin connector is used as the interface port for RS-232C remote operations. The RS-232C interface operates as a full duplex interface at a selectable baud rate of 75 to 9600 bps. Pin 2 of this connector is the transmit data line (TXD), pin 3 is the receive data line (RXD) and pin 7 is ground. See **Section IV** of this manual for details on the RS-232C remote interface and operations.

2.2.3.7 **TB1, Audio Terminal Block (TB1)** - This terminal block contains 13 terminals for connection of various inputs and outputs of the receiver such as line audio outputs, speaker outputs, DC-coupled audio output, remote signal strength indicator output, squelch output, and mute input. These input and outputs at the terminals of A2TB1 are further described in the following paragraphs.

2.2.3.7.1 **Line Audio Outputs (TB1 Terminals 1 thru 6)** - Terminals 1 thru 6 of TB1 provide two, center-tapped balanced line audio outputs. One of the line audio outputs (LINE A) is provided on the combination of terminals 1, 2, and 3. Terminal 1 is the positive output (LINE A (+)), terminal 3 is the negative output (LINE A (-)) and terminal 2 is the ungrounded center tap output (LINE A (CT)).

The other line audio output (LINE B) is provided on the combination of terminals 4, 5, and 6. Terminal 4 is the positive output (LINE B (+)), terminal 6 is the negative output (LINE B (-)), and terminal 5 is the ungrounded center tap output (LINE B (CT)).

When the independent sideband (ISB) detection mode is selected, the LINE A output provides upper sideband (USB) audio while the LINE B output provides lower sideband (LSB) audio. In all other detection modes, the LINE A and LINE B outputs provide identical signal content.

The output signal level for input signals above the AGC threshold is 0 dBm nominal (±3 dB). Output impedance for both line audio outputs is 600 ohms (±30 ohms).

2.2.3.7.2 **Speaker Output (TB1 Terminals 7 and 8)** - Terminals 7 and 8 of TB1 provide an audio output, sufficient to drive an external 8 ohm speaker. Terminal 7 is common (SPEAKER COM), and terminal eight is positive (SPEAKER (+)). The bandwidth of the output audio is 0.1 to 13.0 kHz at ±2 dB. Output level is 1 watt minimum with less than 3% total harmonic distortion.

Lower sideband (LSB) or upper sideband (USB) audio can be selected individually or combined, while in the ISB detection mode, and made available at the speaker output.

2.2.3.7.3 **DC-Coupled Audio Output (TB1 Terminal 9)** - Terminal 9 of TB1 provides a DC-coupled version of the audio provided at the speaker output (see **paragraph 2.2.4.7.2**).

2.2.3.7.4 **Remote Signal Strength Indicator Output (TB1 Terminal 10)** - Terminal 10 of TB1 provides an analog output representing the strength of the current detected signal which can be used to drive an external signal strength indicator. The output is a dc voltage which is a linear representation of the strength of the received signal. The output is 0 Vdc for a signal strength of -120 dBm and +5 Vdc for a signal strength of +10 dBm into a high impedance load.

2.2.3.7.5 **Squelch Output (TB1 Terminal 11)** - Terminal 11 of TB1 provides a low impedance to ground (capable of sinking 150 mA) when the receiver's signal squelch circuitry is activated (i.e., the detected signal is above the set squelch level). This output is provided for system integration of the WJ-8712. This output appears as a +5 Vdc source through a 100 kΩ impedance when signal squelch is not active.

2.2.3.7.6 **Mute Input (TB1 Terminal 12)** - Terminal 12 of TB1 is provided to accept a logic level mute input from an external source. When the input at this terminal is grounded (or driven to a CMOS logic low) all audio outputs of the receiver are disabled.

2.2.3.8 **POWER, 97-253 VAC Line Power Input (FL1J1)** - This three-prong male receptacle mates with the six-foot line power cord that is supplied with the receiver to supply the line voltage for the unit's operation. Acceptable input power is 97 - 253 VAC at 47 to 440 Hz. The WJ-8712 requires approximately 30 watts for operation.

2.2.3.9 **PHONES, Front Panel Headphones Jack (A1J1)** - The PHONES connector located on the front panel is a 1/4-inch stereo headphones jack. Each channel of this output provides a minimum of 10 mW at less than 5% total harmonic distortion into a 600 ohm load, when the input signal is above the AGC threshold. Located beside the PHONES jack on the front panel is a

volume control knob. A clockwise rotation of this knob results in an increase in headphones output signal level. When the independent sideband (ISB) detection mode is selected, the right channel provides lower sideband (LSB) audio while the left channel provides upper sideband (USB) audio. In all other detection modes, both channels provide identical signal content

2.2.3.10 **CONTROL INTERFACE, Front Panel Multi-Pin Connector (W3J1)** - This multi-pin, 25-pin connector is primarily intended for use as a test port for the WJ-8712. It allows an operator to plug in a front panel test fixture, power up the WJ-8712, and quickly verify functionality of the WJ-8712 without having to remove it from the 19" rack in which it is installed. Operation of the front panel test fixture is the same as the front panel operation of the WJ-8711 Digital HF Receiver. Refer to **Appendix C** for the front panel test fixture instructions. The operator can run built-in test to isolate faults within the WJ-8712 to the module level without requiring the use of an external (rear panel connected) RS-232 controller. The front panel control interface is not an RS-232 port.

2.2.3.11 **Ground Stud** - A #10 threaded grounding stud is located on the rear panel for grounding the receiver in an equipment frame. See **Figure 2-2** for the location of this grounding stud.

## 2.2.4 CONFIGURING THE RECEIVER FOR REMOTE OPERATIONS

The WJ-8712 contains two DIP switches that are used to configure the receiver for remote operation. These switches are mounted on the Digital PC Assembly (A2) and are accessed by removing the receiver's bottom cover (see **Figure 2-3**). The switches are designated A2S1 and A2S2. Each switch contains eight rocker-type switches. The rocker switches are on when they are in the down position and are off when in the up position.

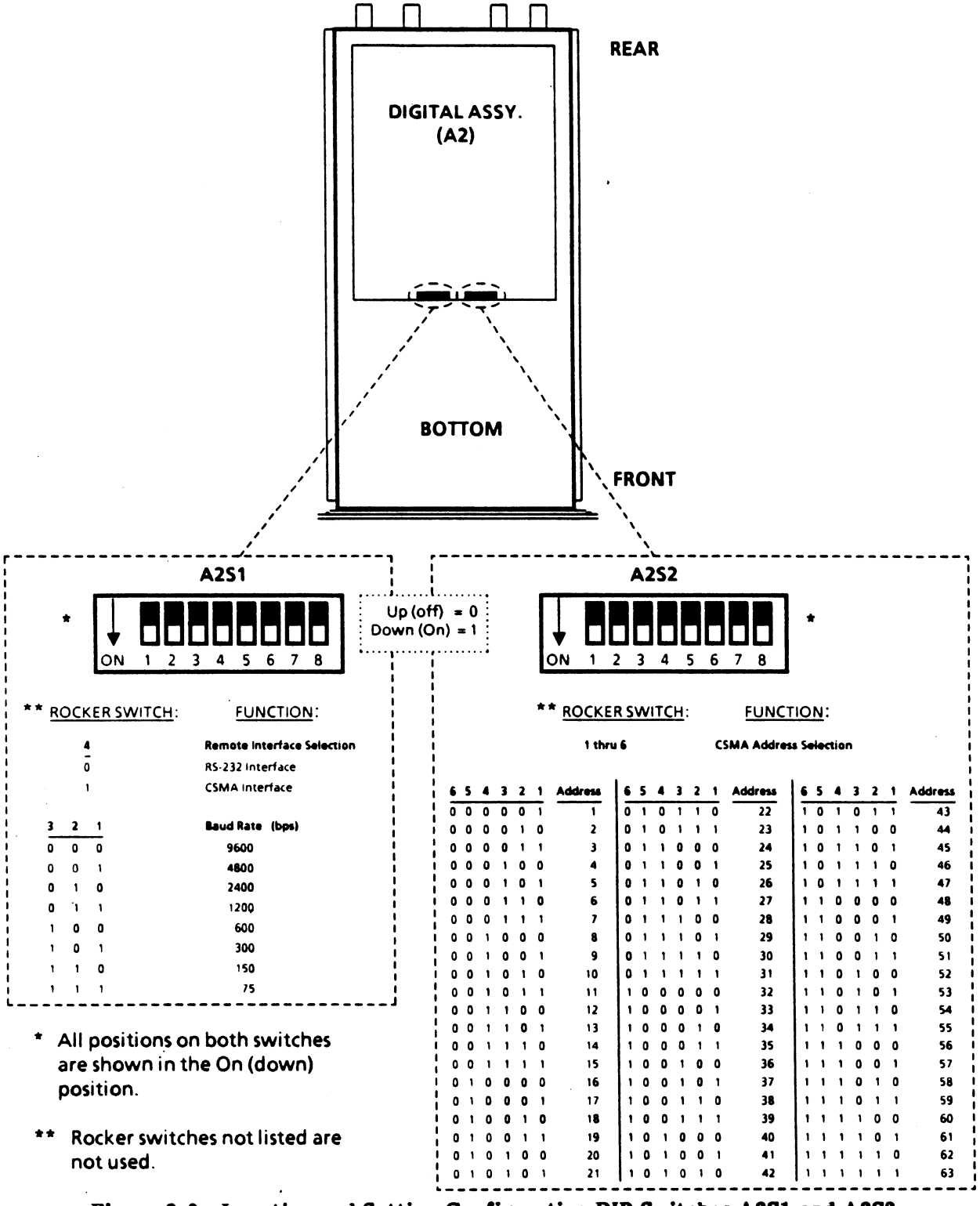
**NOTE**

Use the front panel POWER switch to recycle power after a switch setting change for A2S1 or A2S2.

The rocker switches in A2S1 are used to enable either the RS-232C or the CSMA interface for remote operations, and to set the baud rate for the selected interface. Setting switch 4 of A2S1 to off (up) enables the RS-232C interface. Conversely, setting switch 4 to on enables the CSMA interface.

The positions of switches 1, 2, and 3 of A2S1 are used to set the baud rate for remote operations. Selectable baud rates are 75, 150, 300, 600, 1200, 2400, 4800, and 9600 bps. See **Figure 2-4** for the proper positions of switches 1, 2, and 3 of A2S1 to select the desired baud rate.

Switches 1 thru 6 of A2S2 are used to set the receiver's address on the CSMA bus during CSMA remote operations. Valid addresses are from 01 to 63 (address 00 is reserved). See **Figure 2-4** for the proper positions of switches 1 thru 6 of A2S2 to select the desired CSMA bus address. When it is desirable to have the WJ-8712 emulate the ICOM R71A HF Receiver, the CSMA address should be set to 26.




** ROCKER SWITCH: FUNCTION:

| 4 | |
|---|---|
| 0 | Remote Interface Selection: RS-232 Interface |
| 1 | Remote Interface Selection: CSMA Interface |

| 3 | 2 | 1 | Baud Rate (bps) |
|---|---|---|---|
| 0 | 0 | 0 | 9600 |
| 0 | 0 | 1 | 4800 |
| 0 | 1 | 0 | 2400 |
| 0 | 1 | 1 | 1200 |
| 1 | 0 | 0 | 600 |
| 1 | 0 | 1 | 300 |
| 1 | 1 | 0 | 150 |
| 1 | 1 | 1 | 75 |

* All positions on both switches are shown in the On (down) position.

** Rocker switches not listed are not used.

** ROCKER SWITCH: FUNCTION:

1 thru 6 CSMA Address Selection

| 6 | 5 | 4 | 3 | 2 | 1 | Address |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| 0 | 0 | 0 | 0 | 1 | 1 | 3 |
| 0 | 0 | 0 | 1 | 0 | 0 | 4 |
| 0 | 0 | 0 | 1 | 0 | 1 | 5 |
| 0 | 0 | 0 | 1 | 1 | 0 | 6 |
| 0 | 0 | 0 | 1 | 1 | 1 | 7 |
| 0 | 0 | 1 | 0 | 0 | 0 | 8 |
| 0 | 0 | 1 | 0 | 0 | 1 | 9 |
| 0 | 0 | 1 | 0 | 1 | 0 | 10 |
| 0 | 0 | 1 | 0 | 1 | 1 | 11 |
| 0 | 0 | 1 | 1 | 0 | 0 | 12 |
| 0 | 0 | 1 | 1 | 0 | 1 | 13 |
| 0 | 0 | 1 | 1 | 1 | 0 | 14 |
| 0 | 0 | 1 | 1 | 1 | 1 | 15 |
| 0 | 1 | 0 | 0 | 0 | 0 | 16 |
| 0 | 1 | 0 | 0 | 0 | 1 | 17 |
| 0 | 1 | 0 | 0 | 1 | 0 | 18 |
| 0 | 1 | 0 | 0 | 1 | 1 | 19 |
| 0 | 1 | 0 | 1 | 0 | 0 | 20 |
| 0 | 1 | 0 | 1 | 0 | 1 | 21 |
| 0 | 1 | 0 | 1 | 1 | 0 | 22 |
| 0 | 1 | 0 | 1 | 1 | 1 | 23 |
| 0 | 1 | 1 | 0 | 0 | 0 | 24 |
| 0 | 1 | 1 | 0 | 0 | 1 | 25 |
| 0 | 1 | 1 | 0 | 1 | 0 | 26 |
| 0 | 1 | 1 | 0 | 1 | 1 | 27 |
| 0 | 1 | 1 | 1 | 0 | 0 | 28 |
| 0 | 1 | 1 | 1 | 0 | 1 | 29 |
| 0 | 1 | 1 | 1 | 1 | 0 | 30 |
| 0 | 1 | 1 | 1 | 1 | 1 | 31 |
| 1 | 0 | 0 | 0 | 0 | 0 | 32 |
| 1 | 0 | 0 | 0 | 0 | 1 | 33 |
| 1 | 0 | 0 | 0 | 1 | 0 | 34 |
| 1 | 0 | 0 | 0 | 1 | 1 | 35 |
| 1 | 0 | 0 | 1 | 0 | 0 | 36 |
| 1 | 0 | 0 | 1 | 0 | 1 | 37 |
| 1 | 0 | 0 | 1 | 1 | 0 | 38 |
| 1 | 0 | 0 | 1 | 1 | 1 | 39 |
| 1 | 0 | 1 | 0 | 0 | 0 | 40 |
| 1 | 0 | 1 | 0 | 0 | 1 | 41 |
| 1 | 0 | 1 | 0 | 1 | 0 | 42 |
| 1 | 0 | 1 | 0 | 1 | 1 | 43 |
| 1 | 0 | 1 | 1 | 0 | 0 | 44 |
| 1 | 0 | 1 | 1 | 0 | 1 | 45 |
| 1 | 0 | 1 | 1 | 1 | 0 | 46 |
| 1 | 0 | 1 | 1 | 1 | 1 | 47 |
| 1 | 1 | 0 | 0 | 0 | 0 | 48 |
| 1 | 1 | 0 | 0 | 0 | 1 | 49 |
| 1 | 1 | 0 | 0 | 1 | 0 | 50 |
| 1 | 1 | 0 | 0 | 1 | 1 | 51 |
| 1 | 1 | 0 | 1 | 0 | 0 | 52 |
| 1 | 1 | 0 | 1 | 0 | 1 | 53 |
| 1 | 1 | 0 | 1 | 1 | 0 | 54 |
| 1 | 1 | 0 | 1 | 1 | 1 | 55 |
| 1 | 1 | 1 | 0 | 0 | 0 | 56 |
| 1 | 1 | 1 | 0 | 0 | 1 | 57 |
| 1 | 1 | 1 | 0 | 1 | 0 | 58 |
| 1 | 1 | 1 | 0 | 1 | 1 | 59 |
| 1 | 1 | 1 | 1 | 0 | 0 | 60 |
| 1 | 1 | 1 | 1 | 0 | 1 | 61 |
| 1 | 1 | 1 | 1 | 1 | 0 | 62 |
| 1 | 1 | 1 | 1 | 1 | 1 | 63 |

**Figure 2-3. Locating and Setting Configuration DIP Switches A2S1 and A2S2**

Switch 8 of A2S2 is used to set the tuned frequency command and response formats on the CSMA interface to four bytes or five bytes. Setting this switch to the on (down) position selects the five-byte format and setting it to the off (up) position selects the four-byte format.

When determining the switch settings to achieve a specific binary value, a switch in the off (up) position corresponds to a binary 0 while a switch in the on (down) position corresponds to a binary 1.

**Figure 2-4** gives an example of switches A2S1 and A2S2 set to positions to provide particular configurations. In the example, switch A2S1 is set to select CSMA remote operation with a baud rate of 2400 bps. Switch A2S2 is set to provide a CSMA address of 26 and a four-byte tuned frequency format.

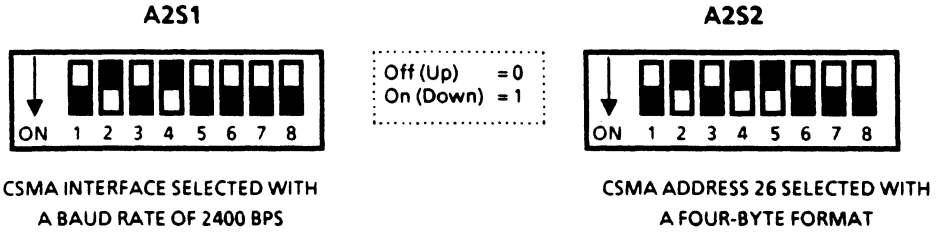



**Figure 2-4. Examples of Set DIP Switches A2S1 and A2S2**

## 2.3 EQUIPMENT MALFUNCTIONS

This unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. If an apparent malfunction is encountered after installation, verify that the correct input signals are present at the proper connectors. Prior to taking any corrective maintenance action or breaking any seals, contact your Watkins-Johnson representative, or the Watkins-Johnson Company Customer Service Department to prevent the possibility of voiding the terms of the warranty. Contact the Watkins-Johnson Company via mail, telephone, wire, or cable at:

Watkins-Johnson Company
Customer Service Department
700 Quince Orchard Road
Gaithersburg, Maryland 20878-1794

Toll Call: (301) 948-7550, Extension 7201
TELEX: 89-8402
TWX: 710-828-0546
TELEFAX: (301) 921-9479
EASYLINK: 62928185

If reshipment is necessary, follow the instructions in the following paragraph (Preparation for Reshipment or Storage). Do not return the equipment until a Return for Maintenance Authorization (RMA) number has been obtained from the Watkins-Johnson Company's Customer Service Department. See Item 10 in the General Terms and Conditions of Sale paper (WJ Form #WJ-151-X) for more information on equipment returns.

## 2.4 PREPARATION FOR RESHIPMENT OR STORAGE

If the unit must be prepared for reshipment, the packaging method should follow the pattern established in the original shipment. Use the best packaging materials available to protect the unit during reshipment or storage. When possible, use the original packing container and cushioning materials. If the original packing materials are not available, use the following procedures:

1. Wrap the unit in sturdy paper or plastic.

2. Place the wrapped unit in a strong shipping container and place a layer of shock-absorbing material (3/4-inch minimum thickness) around all sides of the unit to provide a firm cushion and to prevent movement inside the container.

3. If shipping the unit for service, fill out all information on the 5x6 PRODUCT DISCREPANCY REPORT card (WJ Form #WJC-QA55-0) that was provided with the original shipment. Also ensure that the Return for Maintenance Authorization (RMA) number is recorded on the card. (See **paragraph 2.3** for details on obtaining this number.) If this card is not available, attach a tag to the unit containing the following information:

   a. Return for Maintenance Authorization (RMA) number.
   b. The Watkins-Johnson Type/Model number of the equipment.
   c. Serial number.
   d. Date received.
   e. Date placed in service.
   f. Date of failure.
   g. Warranty adjustment requested, yes or no.
   h. A brief description of the discrepant conditions.
   i. Customer name and return address.
   j. Original Purchase Order/Contract number.

4. Thoroughly seal the shipping container and mark it FRAGILE.

5. Ship to:

   Watkins-Johnson Company
   700 Quince Orchard Road
   Gaithersburg, Maryland 20878-1794
   U.S.A

When storing the equipment for extended periods, follow the above packing instructions to prevent damage to the equipment. The safe limits for storage environment are:

Temperature: -40 to +70°C
Humidity: less than 95%

# SECTION III

# LOCAL OPERATION

# SECTION III

# LOCAL OPERATION

## 3.1 INTRODUCTION

This section provides information related to the local operation of the WJ-8712 Digital HF Receiver using its front panel.

## 3.2 DESCRIPTION OF CONTROLS

The front panel of the receiver contains all of the controls that are used for local and remote operation. The receiver is basically a slave unit controlled by the remote controller as described in **Sections IV** and **V. Figure 3-1** shows the control locations on the front panel.

Front panel controls consist of the illuminated POWER switch, and the PHONES control.

### 3.2.1 THE PHONES OUTPUT VOLUME CONTROL KNOB

The PHONES output volume control knob is located to the right of the PHONES jack on the bottom left-hand corner of the front panel. This knob is used to increase or decrease the volume level of the audio output on both channels of the PHONES jack. A clockwise rotation increases the volume of a nominal audio signal up to approximately 10 milliwatts and a counterclockwise rotation decreases the volume to approximately 0 milliwatt.

### 3.2.2 THE POWER SWITCH

The POWER switch is a rocker-type switch located on the top left-hand corner of the front panel. This switch is used to turn the receiver on and off. When the bottom-half of the switch is pushed in, the receiver is off. Pushing in on the top-half of the switch turns the unit on, illuminates the switch, and starts the power-up and initialization routine (refer to **paragraph 3.3**).

## 3.3 TURNING ON THE RECEIVER

The receiver is turned on when the top-half of the POWER switch is pushed in. From the off state, turning the receiver on causes it to go into its power-up and initialization routine.

After approximately one second, initialization is complete, and the receiver automatically returns to the last set of operating parameters.

The WJ-8712 is equipped with battery backed-up memory. When the receiver is turned off, all current receiver parameters (including channel set-ups) are saved in memory. When the receiver is powered up, the receiver parameters that were set, prior to the receiver being turned off, are reset.

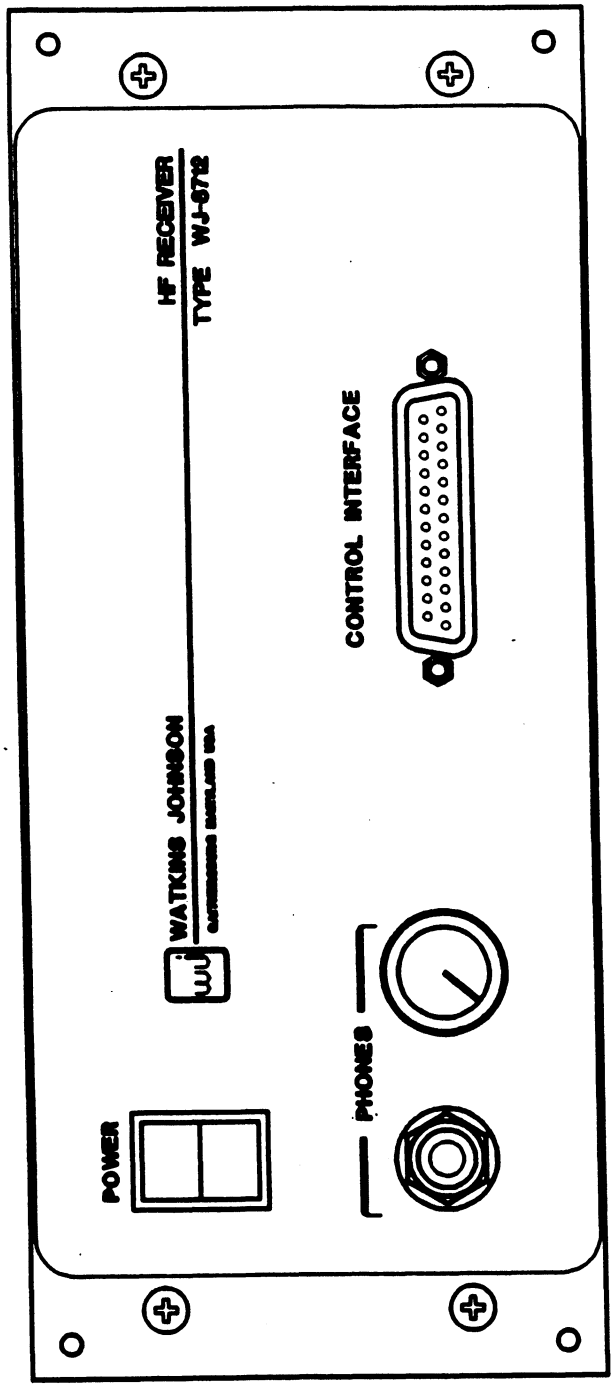



**Figure 3-1. Front Panel Controls and Connectors**

# SECTION IV

# RS-232 REMOTE OPERATION

# SECTION IV

# RS-232 REMOTE OPERATION

## 4.1 INTRODUCTION

The WJ-8712 Digital HF Receiver has the built-in capability of being controlled remotely by a computer or other controller device that is equipped with an RS-232 serial interface and capable of transmitting and receiving ASCII-standard encoded characters. Physically, the controller device needs only a transmit line (TXD), a receive line (RXD), and a ground line to communicate with the receiver.

The WJ-8712 can be set for RS-232 remote control. Switch 4 of DIP switch A2S1 can be set to the off (up) position to activate the RS-232 remote control. A baud rate hardware default can also be selected. Refer to **paragraph 2.2.4** for details on configuring DIP switch A2S1.

Various receiver parameters can be controlled and/or monitored over the RS-232 interface. These parameters are:

- tuned frequency,
- BFO frequency,
- detection mode,
- squelch level,
- speaker type,
- IF bandwidth,
- gain mode,
- built-in-test (BITE) execution,
- error status (both current and latched),
- selection of remote control, or remote control with local lockout,
- selection of F1-to-F2 scan start and stop frequencies,
- selection of channel scan start and stop channels,
- passband tuning offset frequency,
- recall stored parameters from memory,
- external reference,
- signal strength,
- squelch status,
- mute status,
- receiver identity,
- manual gain,
- signal dwell time,
- blanking time,
- selection of channel scanning, F1-to-F2 scanning, or F1-to-F2 scanning with local lockouts,
- selection of F1-to-F2 scan increment,
- selection of frequency lockouts,
- store current WJ-8712 operating parameters to selected memory channel
- store current internal control software version to selected memory channel

This section of the manual contains all the information necessary to enable an operator to control and monitor the above receiver parameters from an RS-232 controller. Details on how to properly format and transmit remote messages and how to read responses from the receiver are provided.

It is recommended that the operator become familiar with the operation of the controller by viewing its literature, prior to remote control operation of the WJ-8712.

**NOTE**

All remote RS-232 messages must be terminated with a line feed. Refer to **paragraph 4.3.1.**

## 4.2 INTERFACING WITH THE WJ-8712

The RS-232 interface of the WJ-8712 is physically implemented on the RS-232 connector (A2J3), located on the rear panel. This interface has a full duplex operation, meaning that it can transmit and receive data simultaneously. The interface is set up as a "three-wire" RS-232 configuration, implemented on the transmit data line (TXD), the receive data line (RXD), and ground. These three wires are provided at the rear panel RS-232 connector on pins 2, 3, and 7, respectively.

This interface supports software handshaking only, including XON/XOFF (receiver protocol) and ACK/NAK (transmitter protocol). Hardware handshake signals such as RTS (request to send), CTS (clear to send), DTR (data terminal ready), or DSR (data set ready) are not supported.

RS-232 serial interfaces use a method of transmitting data one bit at a time over the TXD and RXD lines. For example, an eight-bit character takes eight sequential transmissions to complete the character. In RS-232 serial transmissions, data is sent in frames (or packets). Each bit within the frame is determined by a voltage level. The voltage levels used by this interface are -8 Vdc (nominal) for a logic "1" and +8 Vdc (nominal) for a logic "0". In the inactive or quiet state, the transmit line is held at a logic 1.

The baud rate (rate of data flow in bits per second) for the WJ-8712 is selectable (75, 150, 300, 600, 1200, 2400, 4800, or 9600 bps). Switches 1, 2, and 3 of DIP switch A2S1 can be set to appropriate positions to select the hardware default baud rate. Refer to **paragraph 2.2.5** in **Section II** of this manual for details on configuring DIP switch A2S1.

The WJ-8712 is set up with a fixed data word frame format consisting of ten bits, and comprised of the following:

- one start bit,
- an eight-bit character,
- no parity,
- one stop bit.

An example illustration of the fixed data word format is shown in **Figure 4-1.**

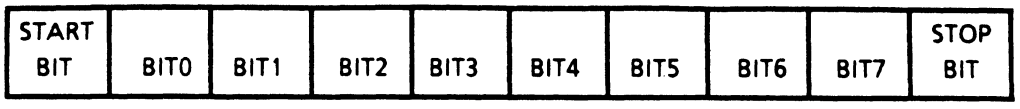



**Figure 4-1. Fixed Data Word Format**

It is important in serial data transmissions that the receiving device knows when data is being transferred and when data being transferred is about to stop. This information is conveyed by the above start and stop bits. The start bit synchronizes the receiving device so it reads the data properly. The stop bit notifies the receiving device that the data frame has ended. The WJ-8712's fixed data word frame format does not contain a parity bit.

## 4.3 COMMAND MESSAGE FORMATTING

Command messages for the WJ-8712 are exclusively ASCII-encoded data, consisting of command headers and arguments. Command headers consist of three character mnemonics. All queries consist of a command header, followed by a question mark (?). All command arguments are in the "forgiving" numerical representation form (refer to **paragraph 4.3.3).**

Command messages are divided into two categories: receiver device messages and communication messages. Refer to **paragraphs 4.4 and 4.5** respectively.

Multiple commands may be sent to the receiver at once by transmitting them as a string. All commands in the string must be separated by a semicolon (;) (i.e., DET 1;BWS 4).

### 4.3.1 TERMINATORS FOR COMMANDS AND QUERIES

Terminators are used to signal the end of a command or string. When a properly formatted message is ready to be sent, a LF (line feed) character should be entered. The LF character instructs the receiver to process the preceding message(s).

The WJ-8712 also transmits a terminator when responding to queries. After the query response is transmitted the receiver issues a CR, LF (carriage return, line feed characters), indicating end of response.

### 4.3.2 FORMATS OF QUERY RESPONSES

The WJ-8712 transmits responses to queries in a fixed-field format. Query responses begin with the three-letter mnemonic of the query in upper-case characters, followed by a numeric argument. In all query responses, the mnemonic and argument are separated by a space. Numeric arguments are represented by the least number of digits possible, while still representing the entire range of the value. If a negative value is allowed for the argument, a positive or negative sign is always given. Responses due to multiple queries are linked together

in a query string, with each query and its argument separated with a semicolon from other queries in the string. The WJ-8712 terminates all responses to single queries or query strings with the CR (carriage return) and LF (line feed) characters.

### 4.3.3 REPRESENTATION OF NUMERIC ARGUMENTS

Arguments for commands and queries in this manual are represented by an nrX (where X is either f, 1, or 2). The nrf representation is used for command numeric arguments. The nr1 and nr2 are used for the representation of query response arguments.

Numeric arguments that are used with commands are accepted in a forgiving numeric representation (nrf). This implies that the WJ-8712 is a forgiving listener. Specific details on numeric representation are given below.

- nrf - The nrf (forgiving numeric representation) data element for commands is composed of the sequential fields listed below. All fields (1-5) are optional with one restriction: at least one digit must be present with the active data element of the argument.

| Field | Data |
|---|---|
| 1 | Plus (+) or minus (-) sign. |
| 2 | Any number of digits, up to eight. |
| 3 | A decimal point (.). |
| 4 | Any number of digits, up to eight. |
| 5 | An upper-case "E" or lower-case "e" followed by an optional sign and at least one digit but no more than two digits. |

  If the WJ-8712 receives an nrf of a precision greater than it can handle, it rounds the number rather than truncating it. When rounding, the unit ignores the sign of the number and rounds up on values greater than or equal to one half. It rounds down on values less than one half.

- nr1 - The nr1 is a numeric query response data format for integers, composed of an optional sign field, followed by any number of digits. The decimal point is implicitly defined to always follow the last digit and is therefore, not present in the response data element.

- nr2 - The nr2 numeric response data format is composed of an optional sign field, followed by any number of digits, a decimal point, and any number of digits. At least one digit is always present on both sides of the decimal point.

## 4.4 RECEIVER DEVICE MESSAGES

Receiver Device Messages are commands that affect the operational parameters of the receiver. These commands are listed in **Table 4-1.** The following paragraphs provide information on the setting and/or selection of a number of the operational parameters listed in **Table 4-1.**

**Table 4-1. Receiver Device Messages**

| Command | Response | Description |
|---|---|---|
| ADV | | Advance to next scan frequency. Operates when WJ-8712 is in dwell mode during scan. |
| AGC nrf | | Select gain control mode. Refer to **paragraph 4.4.3.**<br>Range: 0 - 2<br>Where: 0 - Manual<br>1 - Slow AGC<br>2 - Fast AGC |
| AGC? | AGC nr1 | Request active gain control mode.<br>Reset: AGC 2<br>Default: AGC 2<br>Example: AGC 0 |
| BFO nrf | | Set frequency in Hz (10 Hz steps). Refer to **paragraph 4.4.5.**<br>Range: -8000 to +8000<br>Where: +0000 = No BFO Offset |
| BFO? | BFO nr1 | Request current BFO frequency.<br>Reset: BFO +1000<br>Default: BFO +1000<br>Example: BFO -7990 |
| BLK nrf | | Select blanking time in milliseconds.<br>Range 0 to 10 |
| BLK? | BLK nr1 | Request active blanking time in milliseconds.<br>Example: BLK 05<br>Default: BLK 00 |
| BWS nrf | | Select an IF bandwidth. Refer to **paragraph 4.4.4.**<br>Range: 1 - 5<br>Where: 1 - 0.30 kHz<br>2 - 1.00 kHz<br>3 - 3.20 kHz<br>4 - 6.00 kHz<br>5 - 16.0 kHz |
| BWS? | BWS nr1 | Request the active IF bandwidth slot.<br>Reset: BWS 4<br>Default: BWS 4<br>Example: BWS 1 |

**Table 4-1. Receiver Device Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| CHA nrf | | Select start channel for channel scan. Refer to **paragraph 4.4.6.1.**<br>Range: 0 to 98 |
| CHA? | CHA nr1 | Request currently selected start channel for channel scan.<br>Example: CHA 25<br>Default: CHA 00 |
| CHB nrf | | Select stop channel for channel scan. Refer to **paragraph 4.4.6.1.**<br>Range: 01 to 99 |
| CHB? | CHB nr1 | Request currently selected stop channel for channel scan.<br>Example: CHB 26<br>Default: CHB 99 |
| CHI nrf | | Include channel when in channel scan. Refer to **paragraph 4.4.6.1.**<br>Range: 0 to 99 |
| CHS nrf | | Skip channel when in channel scan. Refer to **paragraph 4.4.6.1.**<br>Range: 0 to 99 |
| CLM | | Clear all memories. |
| CTL nrf | | Set the device control mode.<br>Range: 0 - 2<br>0 - Local, Valid only with the Type TF-30387 Test Fixture connected.<br>Where: 1 - Remote<br>2 - Remote w/Local Lockout |
| CTL? | CTL nr1 | Request the device control mode.<br>Default: CTL 1<br>Example: CTL 2 |

**Table 4-1. Receiver Device Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| DET nrf | | Set the detection mode. Refer to **paragraph 4.4.2.**<br>Range: 1 - 6<br>Where: 1 - AM<br>2 - FM<br>3 - CW<br>4 - USB<br>5 - LSB<br>6 - ISB |
| DET? | DET nr1 | Request the active detection mode.<br>Reset: DET 1<br>Default: DET 1<br>Example: DET 4 |
| ENA | | Continue suspended scan command. Refer to **paragraph 4.4.6.** |
| EXE nrf | | Recall and execute specified memory channel.<br>Range: 0 to 99 |
| FRA nrf | | Select start frequency for Frequency-to-Frequency (F1-to-F2) scan in MHz. Refer to **paragraph 4.4.6.2.**<br>Range: 0.000000 to 29.999999 |
| FRA? | FRA nr2 | Request current Frequency-to-Frequency (F1-to-F2) scan start frequency in MHz.<br>Example: FRA 23.123456<br>Default: FRA 00.000000 |
| FRB nrf | | Select stop frequency for Frequency-to-Frequency (F1-to-F2) scan in MHz. Refer to **paragraph 4.4.6.2.**<br>Range: 0.000001 to 30.000000 |
| FRB? | FRB nr2 | Request current Frequency-to-Frequency (F1-to-F2) scan stop frequency in MHz.<br>Example: FRB 27.123456<br>Default: FRB 30.000000 |

**Table 4-1. Receiver Device Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| FRQ nrf | | Set the tuned frequency in MHz (1-Hz steps). Refer to **paragraph 4.4.1.** Range: 00.000000 to 30.000000 |
| FRQ? | FRQ nr1 | Request the tuned frequency. Reset: FRQ 20.000000 Default: FRQ 20.000000 Example: FRQ 12.345678 |
| INC nrf | | Select Frequency-to-Frequency (F1-to-F2) scan increment in kHz. Refer to **paragraph 4.4.6.2.** Range: 0.001 to 25.000 |
| INC? | INC nr2 | Request current Frequency-to-Frequency (F1-to-F2) scan increment in kHz. Example: INC 20.000 Default: INC 25.000 |
| LCK nrf nrf | | Enter a lockout to be used in the (F1-to-F2) scan w/Lock mode. The lockout is specified as a center frequency only. The lockout width is ± half of the current IF bandwidth selection. Once stored, the lockout width remains the same, regardless of future IF bandwidth changes. The channel number assigned with this command remains constant as channels are added or deleted. This lockout data overwrites any data previously stored in the selected lockout channel. Refer to **paragraph 4.4.6.3.** |
| Field | Parameter | Range |
| 1 | Channel number | 0 to 99 |
| 2 | Lockout center frequency | 0.000000 to 30.000000 |
| MUT? | MUT nr1 | Request the current mute status. Refer to **paragraph 4.4.7.** Range: 0, 1 Where: 0 = Audio not muted 1 = Audio muted |

**Table 4-1. Receiver Device Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| OPR nrf | | Select operation mode. Refer to **paragraph 4.4.6.**<br>Range: 0, 1<br>Where: 0 = manual<br>1 = scan (type of scan is dependent on current scan type (SCF) selection.) |
| OPR? | OPR nr1 | Request current operation mode.<br>Example: OPR 1<br>Reset: OPR 0<br>Default: OPR 0 |
| PBT nrf | | Selected passband tuning offset frequency. Only effective in CW detection mode. Refer to **paragraph 4.4.5.**<br>Range: -2000 to +2000 Hz (10 Hz steps) |
| PBT? | PBT nr1 | Request current passband tuning offset frequency in Hz.<br>Example: PBT 1250<br>Reset: PBT 0 |
| RCL? nrf | RCL nr1,nr1, nr2,nr1,nr1,nr1, nr1,nr1 | Recall selected memory channel parameters.<br>Range: 0 to 99 |

| Field | Parameter | Range |
|---|---|---|
| 1 | Memory channel number | 0 to 99 |
| 2 | Skip/include channel | 0 = skip, 1 = include |
| 3 | Tuned frequency (FRQ) | 00.000000 to 30.000000 MHz |
| 4 | AGC mode (AGC) | 0 to 2 |
| 5 | Detection mode (DET) | 1 to 6 |
| 6 | Bandwidth slot (BWS) | 1 to 5 |
| 7 | Squelch threshold (SQL) | 0 to 135 -dBm, 136 = no squelch |
| 8 | RF input (RFP) | 1 to 3 |

**Table 4-1. Receiver Device Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| REF? | REF nr1 | Request the status of the external reference.<br>Range: 0 - 4<br>Where: 0 - Internal<br>1 - 10 MHz External<br>2 - 5 MHz External<br>3 - 2 MHz External<br>4 - 1 MHz External<br>Example: REF 3 |
| RFG nrf | | Set the remote manual gain level. Refer to **paragraph 4.4.3.**<br>Range: 000 - 127 |
| RFG? | RFG nr1 | Request the remote manual gain level.<br>Reset: RFG 000<br>Default: RFG 000<br>Example: RFG 123 |
| RFP nrf | | Select the RF input path. Refer to **paragraph 4.4.9.**<br>Range: 1 - 3<br>Where: 1 - Normal<br>2 - Attenuated<br>3 - Preamplified |
| RFP? | RFP nr1 | Request the selected RF input path.<br>Reset: RFP 1<br>Default: RFP 1<br>Example: RFP 2 |
| RLK? nrf | RLK nr1,nr2 | Recall the selected lockout channel center frequency. When the lockout memory channel is vacant a frequency of 31.000000 MHz is returned.<br>Range: 0 to 99<br>Example: RLK 12,27.123456 |
| SCF nrf | | Select desired scan type. Refer to **paragraph 4.4.6.**<br>Range: 1 to 3<br>Where: 1 = Channel scan<br>2 = F1-to-F2<br>3 = F1-to-F2 w/Lock |
| SCF? | SCF nr1 | Request the currently selected scan type.<br>Example: SCF 1<br>Default: SCF 2 |

**Table 4-1. Receiver Device Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| SCS? | SCS nr1 | Request the current receiver scan status.<br>Range: 0 to 3<br>Where: 0 = No scan<br>1 = Scan<br>2 = Scan dwell<br>3 = Scan paused |
| SDW nrf | | Select the scan dwell time. Refer to **paragraph 4.4.8.**<br>Range: 0.5 to 20 seconds, 0 = infinite |
| SDW? | SDW nr1 | Request currently selected scan dwell time.<br>Example: SDW 2<br>Default: SDW 0.5 |
| SGV? | SGV nr1,nr1 | Request the signal strength value (in dBm) and squelch status value.<br>Range: +20 to -135,0-1<br>Where: nr1,0 - squelch on<br>nr1,1 - squelch off<br>Reset: No Change<br>Example: SGV -123,0 |
| SLM? | SLM nr1 | Request number of unused lockout channels available.<br>Range: 0 to 100<br>Example: SLM 75<br>Reset: SLM 100 |
| SPK nrf | | Select speaker output. Refer to **paragraph 4.4.2,** ISB detection mode.<br>Range: 1 to 3<br>Where: 1 = USB<br>2 = Both<br>3 = LSB |
| SPK? | SPK nr1 | Request currently selected speaker output.<br>Example: SPK 2<br>Default: SPK 2 |
| SQL nrf | | Set squelch level in negative dBm. Refer to **paragraph 4.4.7.**<br>Range: 0 to 135, 136 = squelch off |
| SQL? | SQL nr1 | Request the squelch level setting in -dBm (136 = squelch off).<br>Example: SQL 90<br>Reset: SQL 136 |
| STO nrf | | Store current receiver parameters to selected memory channel. Refer to **paragraph 4.4.6.1.**<br>Range: 0 to 99 |

**Table 4-1. Receiver Device Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| SUS | | Suspend scan command. Scan may be continued using the ENA command. Refer to **paragraph 4.4.6.1.** |
| ULK nrf | | Unlock selected lockout memory channel. Range: 0 to 99. Refer to **paragraph 4.4.6.3.** |

### 4.4.1 SETTING THE TUNED FREQUENCY

The frequency command (FRQ) allows the tuned frequency of the WJ-8712 to be set over the 0 to 30 MHz range in 1-Hz increments. Receiver performance is degraded below 500 kHz.

### 4.4.2 DETECTION MODE SELECTION

The detection mode command (DET) determines how the signal is to be demodulated. The receiver supports AM, FM, CW, USB, LSB and ISB detection modes. When the AM, FM, or CW detection modes are selected, any of the five available IF bandwidths may also be selected (**paragraph 4.4.4**). Selecting ISB, USB, or LSB detection modes automatically selects the 3.20 kHz IF bandwidth. Operation with these detection modes is further described below.

In all detection modes except for Independent Sideband (ISB), the demodulated audio, provided at each of the outputs contains the same signal information. After demodulation, the audio is routed to the LINE A, LINE B, SPEAKER, and DC AUDIO terminals of the rear panel terminal bus (TB1). The audio is also directed to the Left and Right channels of the PHONES jack. In the ISB detection mode, both the upper and lower sidebands are simultaneously demodulated, and the audio signals are routed in a manner that permits both sidebands to be simultaneously monitored. The lower sideband audio is routed to the Left channel of the PHONES jack and to the LINE B terminals of TB1. The upper sideband audio is routed to the Right channel of the PHONES jack and to the LINE A terminals of TB1. The audio present at the DC AUDIO and SPEAKER terminals of TB1 are selectable, using the SPK command. Upper sideband audio (SPK 1), lower sideband audio (SPK 2), or both (SPK 3) may be selected, as desired.

### 4.4.3 GAIN CONTROL MODE SELECTION

The receiver supports Automatic Gain Control (AGC) or manual attenuation operations for output level control. The operator may select Manual (AGC 0), Slow AGC (AGC 1), or Fast AGC (AGC 2) via the AGC command.

Two modes of AGC are available: fast or slow. The fast AGC mode provides a 15 millisecond attack time and a 25 millisecond decay time which makes it a more suitable selection when monitoring signals in the AM and FM detection modes. The slow AGC mode provides a 15 millisecond attack time and a 4 second decay time which is best suited for monitoring signals in the CW, USB, LSB, and ISB detection modes. Attack time and decay time are defined as the length of time that it takes for the audio outputs to return to a nominal level after a moderate instantaneous increase or decrease in the input signal level has occurred, respectively.

When in the Manual Gain Control mode (AGC 0), the RFG command sets the receiver gain. The manual gain range of 0 to 100 dB is divided into 127 increments.

### 4.4.4 IF BANDWIDTH SELECTION

The operator may select one of five IF Bandwidths. Selectable IF bandwidths are 0.3, 1.0, 3.2, 6.0 and 16.0 kHz. The BWS (Bandwidth Slot) command is used to select the IF bandwidth.

**NOTE**

The IF bandwidth selection is automatically set to 3.20 kHz when the ISB, USB, or LSB detection modes are selected (**paragraph 4.4.2**). When any of these three detection modes are selected, attempts to select a different IF bandwidth are ignored. When changing the detection mode from ISB, USB, or LSB to AM, FM, or CW, the IF bandwidth returns to the IF bandwidth that was previously active.

### 4.4.5 BFO FREQUENCY AND PASSBAND TUNING IN CW DETECTION MODE

For CW detection mode operations, the Beat Frequency Oscillator (BFO) and passband tuning capabilities are available. The BFO is adjustable over a ±8000 Hz range in 10-Hz steps. The BFO frequency can be applied to the received CW signal to alter its audio pitch as a detection aid. Passband tuning, which is an operator aid that facilitates simultaneous adjustments of tuned frequency and BFO, is adjustable over a ±2000 Hz range in 10-Hz steps. The BFO and passband frequencies are respectively selected by the BFO and PBT commands. The passband tuning function has the effect of shifting the IF bandwidth without changing the frequency of the audio output signals so that unwanted CW signals can be placed outside of the IF bandwidth while keeping the desired CW signals inside the bandwidth. This is especially useful in FSK demodulation applications for monitoring mark and space frequencies while other CW signals close in frequency are present.

### 4.4.6 FLEXIBLE SCANNING MODES

The WJ-8712 Digital HF Receiver provides a selection of three types of frequency scanning, The F1-to-F2 and F1-to-F2 with Lockouts provide a signal search capability within a contiguous segment of the specified portion of the RF spectrum. These two scan types are identical in operation, except that the F1-to-F2 with Lockouts permits undesired signal activity to be locked out, causing them to be ignored during the scan process. The third scan type is the Channel Scan. This scan type causes the receiver to step through a sequence of discrete frequencies programmed in memory. Prior to using any of the three scan types, the receiver memory must be programmed with the appropriate receiver parameters, and the desired scan type must be selected.

Once the receiver is properly programmed, the scan is initiated by first selecting the scan type (SCF 1, SCF 2, SCF 3) and then activating the scan operation (OPR 1). When activated, the scan begins, and continues until a signal exceeding the receiver squelch level is encountered. It dwells on the intercepted signal for the specified dwell time (SDW x.x), and then continues. The receiver may be commanded to continue scanning before the dwell time expires by sending a command to advance (ADV).

At any time the selected scan may be terminated (OPR 0), or temporarily suspended (SUS) to regain manual receiver control. If the scan is suspended (SUS), it is temporarily stopped and manual control is permitted. This permits changing of receiver parameters to optimize the signal, changing the receiver memory contents, storing parameters into channel memory, changing the dwell time, and storing lockout frequencies. If the scan is suspended with SUS command, it may be restarted with the ENA command. This causes the scan to restart at the point where it was suspended, without having to restart from the beginning. If the scan is terminated (OPR 0), it may only be restarted with the OPR 1 command, forcing it to restart at the beginning of the sequence.

#### 4.4.6.1 Channel Scan

In channel scan, the receiver steps through a sequence of up to 100 user programmable memory channels. Receiver parameters stored in each channel include frequency, IF bandwidth, detection mode, gain control, and squelch control. The store (STO) command is used to store current receiver parameters to a selected memory channel. Prior to initiating the channel scan, the operator may select a specific range of channels to scan through. The CHA command is used to select the start channel. CHB is the stop channel selection command. The CHI and CHS commands are respectively used to include or skip a selected channel in the channel scan mode.

#### 4.4.6.2 Frequency-To-Frequency Scan (F1-to-F2)

In the frequency-to-frequency scan (F1-to-F2) mode, the receiver monitors frequencies between programmed start and stop frequencies according to a selected step size between 1 Hz and 25 kHz. The INC command is used to select the increment step size. FRA and FRB commands are used to select start and stop frequencies in the frequency-to-frequency (F1-to-F2) scan mode.

#### 4.4.6.3 Frequency-To-Frequency Scan With Lockouts

In addition to the LCK and ULK commands the commands used for this scan mode are the same as those described in **paragraph 4.4.6.2.** To enter a lockout frequency in the (F1-to-F2) scan with lock mode use the LCK command. The lockout is specified as a center frequency only. Refer to **Table 4-1** for the operating parameters of the LCK command. The ULK command is used to unlock a previously selected lockout memory channel.

### 4.4.7 THE SQUELCH LEVEL SELECTION

For both the fixed frequency tuning and flexible scanning modes of operation the squelch level is set by utilizing the SQL command. In addition to the off setting, the squelch range is from 0 to 135 expressed in negative dBm. Squelch off is 136.

The squelch can be adjusted to a level, depending on the strength of the signals being received. If a signal is received that is not quite strong enough for proper demodulation (i.e., its audio is unclear), the squelch level can be adjusted to block it from being applied to the audio outputs. The squelch should be set to a level where it does not block clear signals but does block noisy unwanted signals. Several adjustments may have to be made to find the optimum level. Only signals that have a power level above the set squelch level will be provided at the audio outputs.

Terminal 12 (MUTE) of TB1 on the rear panel is provided for the input of external squelch control in system setups. When an external mute is asserted (mute line pulled low), the receiver's squelch is activated. The receiver mute status may be requested in accordance with the MUT? query. Refer to **Table 4-1** for the MUT command parameters.

### 4.4.8 DWELL TIME SELECTION

The duration of time the receiver holds on a signal before resuming scan (dwell time) is operator-selectable between 0.5 and 20 seconds. An infinite dwell time can also be selected. The SDW command is used to set the dwell time. An infinite setting is obtained by the 0 (zero) setting.

### 4.4.9 RF INPUT PATH SELECTION

Depending on the receiver's tactical location, signals may be, in general, too powerful or not powerful enough for ideal reception. In these situations the input signals can be attenuated or amplified by selecting the appropriate RF input path for the input signals. The RFP command is used to make the selection, which can be normal, attenuated, or preamplified.

When preamplified is selected, all input signals are amplified by 10 dB. When attenuated is selected, all input signals are attenuated by 15 dB. When normal is selected, the input signals are unaffected at this point.

### 4.4.10 EXECUTE BUILT-IN TEST (BITE) FUNCTION

The Built-in Test (BITE) function is executed by the TST command. This command is a communication message, and is listed in **Table 4-2.** The command is used to verify equipment performance in accordance with the parameters shown in **Table 4-2.**

## 4.5 COMMUNICATION MESSAGES

Communication messages are always valid. These are commands which establish communications between the WJ-8712 and the controller. All WJ-8712 communication messages are listed in **Table 4-2.** Common communication messages are prefixed with an asterisk.

**Table 4-2. Communication Messages**

| Command | Response | Description |
|---|---|---|
| CDE? | CDE nr1 | Request the current Device-Dependent Error Register value.<br><br>Example: CDE 00255<br>Range: 00000 - 65535<br>See Table 4-6 for bit-mapped detail. |
| *CLS | | Clears all communication status registers. |
| *ESE nrf | | Set the Event Summary Enable Register. See discussion of the Event Summary Registers for bit-mapped details.<br>Range: 0 - 255 |
| *ESE? | *ESE nr1 | Request the Event Summary Enable Register value.<br>Reset: No Change<br>Default: *ESE 000<br>Example: *ESE 128 |
| *ESR? | *ESR nr1 | Request the Event Summary Status Register value. See Table 4-4 for bit-mapped details.<br>Example: *ESR 016<br>Range: 0 - 255<br><br>Bit 0 - OPC Operation Complete<br>Bit 1 - Not Used<br>Bit 2 - QYE Query Error<br>Bit 3 - DDE Device-Dependent Error<br>Bit 4 - EXE Execution Error<br>Bit 5 - CME Command Error<br>Bit 6 - Not Used<br>Bit 7 - PON Power On |

**Table 4-2. Communication Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| *IDN? | *IDN (see example) | Request receiver identity. The fields provide information in the following order: model number, space reserved for future expansion, and software version number.<br>Example: *IDN WJ8712,0,1.40 |
| LDE? | LDE nr1 | Request the latched Device-Dependent Error Register value.<br>Example: LDE 00255<br>Range: 00000 - 65535<br>See **Table 4-6** for bit-mapped detail. |
| *LRN? | *LRN nr2,nr1, nr1,nr1,nr1,nr1, nr1,nr1, | Request current WJ-8712 operating parameters. The data returned for this query is field dependent. |

| Field | Parameter | Range |
|---|---|---|
| 1 | Tuned frequency (FRQ) | 00.000000 to 30.000000 MHz |
| 2 | AGC mode (AGC) | 0 to 2 |
| 3 | Detection mode (DET) | 1 to 6 |
| 4 | Bandwidth slot (BWS) | 1 to 5 |
| 5 | Squelch threshold (SQL) | 0 to 135 -dBm, 136 = no squelch |
| 6 | RF input (RFP) | 1 to 3 |
| 7 | BFO frequency (BFO) | -8000 to +8000 Hz (in 10 Hz steps) |
| 8 | Blanking time (BLK) | 0 to 10 milliseconds |
| 9 | Speaker (SPK) | 1 to 3 |

| | | |
|---|---|---|
| *OPC | | Operation complete switch. When this command is sent with a data string, the OPC bit in the Event Summary Status Register will be set upon completion of the operation(s) in the input buffer. An SRQ may be generated with corresponding bit enabled. |
| *OPC? | *OPC 1 | An *OPC 1 string will be loaded into the output buffer (returned at the completion of the operation in the input buffer). |

**Table 4-2. Communication Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| *RSE nrf | | This command allows writing to a register that enables interrupts to be passed from the RSR register to the *STB register via its RSB bit. The interrupts occur only when the receiver is in one of the scan modes.<br><br>BIT FUNCTION<br><br>0 Enable PRS, signal exceeded SQL event to set the RSB bit.<br>1-3 Not used<br>4 Enable ESN, end of single scan event to set the RSB bit.<br>5-7 Not used |
| *RSE? | *RSE nr1 | Request the contents of the Receiver Status Enable Register.<br><br>Reset: no change<br>Default: *RSE 000<br>Example: *RSE 016 |
| *RSR? | *RSR nr1 | Read the Receiver Status Register. The information included in this register is latched. It is cleared by the *CLS command or a read of the register. The information in the register discloses the reason for the RSB bit to be set in the Status Byte Register. The register bits are set only when the receiver is in one of the Scan modes.<br><br>BIT FUNCTION<br><br>0 PRS, signal exceeded SQL threshold. This is an edge triggered event on the action of a signal going from below SQL threshold to above SQL threshold.<br>1-3 Not used<br>4 ESN, end of single scan. This bit indicates the end of scan has been encountered. This bit is only set while in a scan mode. (F1→F2, F1→F2 w/Lock, Channel)<br>5-7 Not used |
| *RST | | For all device parameters to their reset condition. |

**Table 4-2. Communication Messages** (Continued)

| Command | Response | Description |
|---|---|---|
| *SRE nrf | | Set the Service Request Enable Register. See discussion of the Status Byte Registers for bit-mapped details.<br>Range: 0 - 255 |
| *SRE? | *SRE nr1 | Request the Service Request Enable Register value.<br>Reset: No Change<br>Default: *SRE 000<br>Example: *SRE 032 |
| *STB? | *STB nr1 | Request the Status Byte Register value. See Table 4-3 for bit-mapped details.<br>Range: 0 - 255<br>Example: *STB 064<br><br>Bit 0 - RSB Receiver Status Bit<br>Bit 1 - Not Used<br>Bit 2 - Not Used<br>Bit 3 - Not Used<br>Bit 4 - Not Used<br>Bit 5 - ESB Event Summary Bit<br>Bit 6 - RQS Request Service<br>Bit 7 - Not Used |
| *TST? | *TST nr1 | Execute built-in-test (BITE) and report outcome. The response is a bit-mapped value of 16 bits, representing the success or failure of each test. Any failed test will set the associated bit as listed below.<br>Range: 0 - 65535<br>Example: *TST 00000<br><br>Bit — Failure<br><br>0 Control to DSP transmit pipeline not empty.<br>1 Control to DSP download unsuccessful.<br>2 DSP EPROM download unsuccessful.<br>3 Control command not acknowledged.<br>4 No DSP response to control request.<br>5 DSP memory check did not complete<br>6 DSP EPROM failure.<br>7 DSP SRAM failure.<br>8 RF test failed.<br>9 Control A/D failure.<br>10 Non-SSB audio failure.<br>11 USB audio failure.<br>12 USB audio in LSB path failure.<br>13 LSB audio failure.<br>14 LSB audio in USB path failure.<br>15 DSP A/D failure. |

## 4.6 RECEIVER STATUS SUMMARY

**Figure 4-2** illustrates the architecture of the receiver's status registers. It is composed of six eight-bit registers and one 16-bit register, whose logic gating allows the programmer great flexibility in remote operations. The eight bit registers can be split into three pairs. Each pair consists of a status register and an enable register.

One pair is composed of the Event Summary Status Register (whose functions are summarized in **paragraph 4.6.2**) and the Event Summary Status Enable Register. Each bit in the Event Summary Status Register is logically ANDed to a bit in the Event Summary Status Enable Register. The ANDed combination of these two registers are logically ORed to set the Event Summary Status Bit (ESB) of the Status Byte Register. The Device-Dependent Error Bit (DDE) of the Event Summary Status Register is the ORed combination of the 16-bit Device-Dependent Error Register (see **paragraph 4.6.4**).

The second pair is composed of the Status Byte Register and the Service Request Enable Register. The receiver uses only two bits of the Status Byte Register as described in **Table 4-3.** The ANDed combination of bit 5 of the Status Byte Register and the Service Request Enable Register are logically ORed to determine the setting of bit six (RQS) of the Status Byte Register. If the RQS bit is set high, a service request is asserted.

**Table 4-3. Status Byte Register, Bit Evaluation**

| Bit Number | Mnemonic | Description |
|---|---|---|
| 0 | RSB | **Receiver Status Bit** - This bit, when set, indicates that an event has caused a bit or bits in the Receiver Status Register to be set (see **paragraph 4.6.3**). This bit is cleared by *CLS or by reading the contents of the Receiver Status Register using the RSR? query. |
| 1 - 4 | Not Used | |
| 5 | ESB | **Event Summary Bit** - This bit, when set, indicates that the Event Summary Status Register has set SRQ. By reading the Event Summary Status Register via the *ESR? mnemonic, the host controller may identify what status event has caused the SRQ. This bit is cleared by sending, *CLS or reading the contents of the Event Status Register. |
| 6 | RQS | **Request Service Bit** - This bit, when set, indicates that the unit has asserted SRQ. |
| 7 | Not Used | |

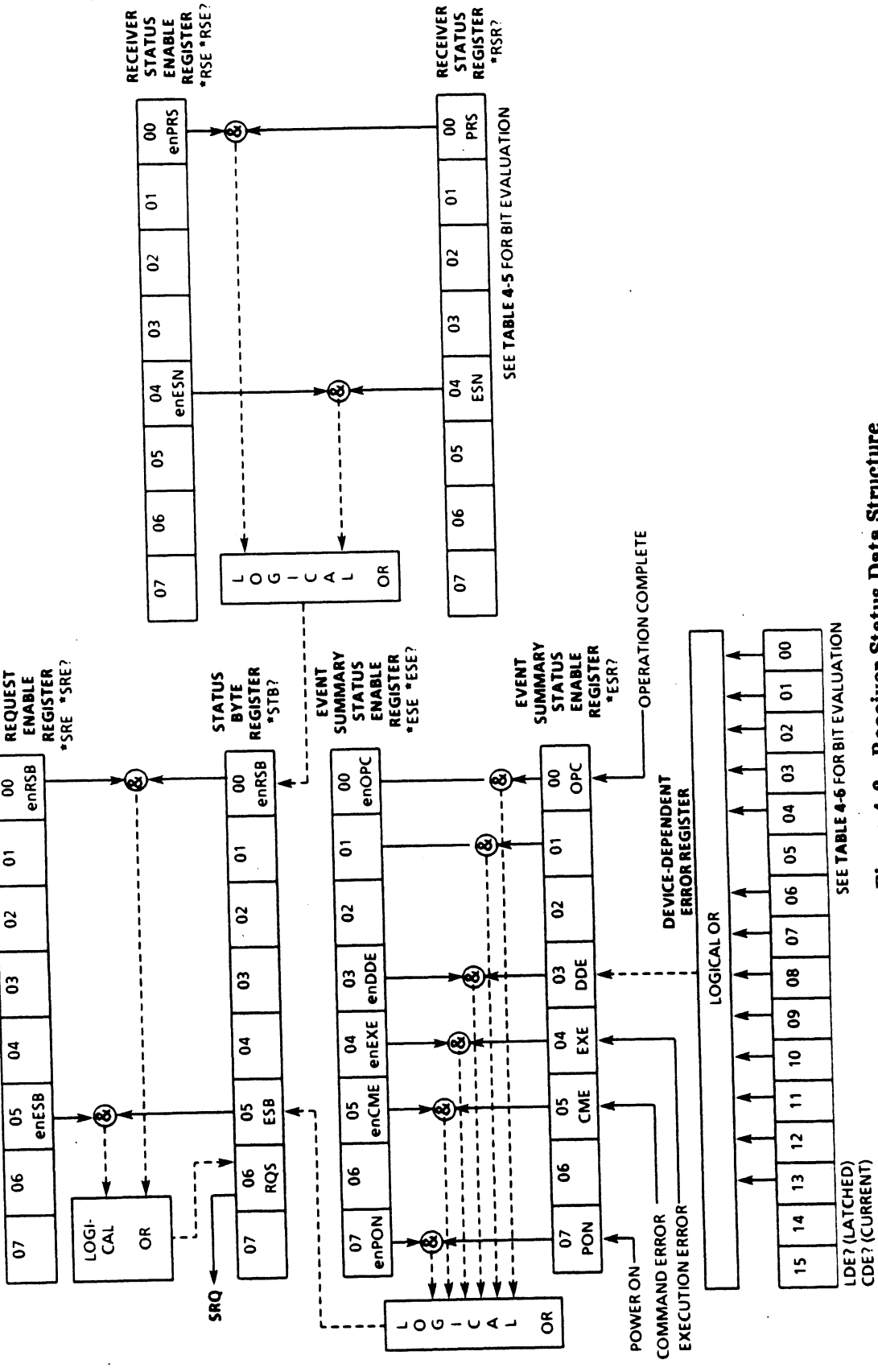



**Figure 4-2. Receiver Status Data Structure**

### 4.6.1 STATUS BYTES

The following information discusses the operation of the SRQ interrupt and the "*STB?" query. The operation of these is very similar. The SRQ interrupt allows the controller to establish which event has caused the receiver to set the SRQ. The "*STB?" query response includes similar information as detailed below.

**SRQ** - This is a one byte control character (ESC) indicating a service request. When SRQ is generated, it is immediately followed by the output of the Status Byte Register, if enabled. The evaluation of each bit in this status byte is in **Table 4-3.**

***STB? Query** - The Status Byte Register can also be read using the *STB? query. Sending *STB? returns the contents of the Status Byte Register, and resets the register to 000.

The Service Request Enable Register allows status bits to generate service requests. Setting a status bit will set service request if and only if the corresponding enable bit is set. Service Request Enable Register bit six is ignored and reported as zero. This bit would correspond to the RQS bit of the Status Byte Register which triggers service request.

### 4.6.2 EVENT SUMMARY STATUS REGISTER

The following discussion covers the Event Summary Status Register and the *ESR? query. See **Table 4-4** for the Event Summary Status Register bit numbers, mnemonics and descriptions.

The Event Summary Status Register is read destructively by the *ESR? query, which clears the register. The *CLS command also clears the register. The power on sequence automatically sets the Power On bit and initially resets the remaining bits.

The Event Summary Status Enable Register allows the event flags of the Event Summary Status Register to be reflected in the Event Summary Bit (ESB) of the Status Byte. The setting of an event status flag sets ESB high only if the corresponding bit in the Event Summary Status Enable Register is set high. The Event Summary Status Enable Register is written to with the *ESE command. The data following the mnemonic is the decimal equivalent of a binary number representing the register bits. The *ESE? query loads the output buffer with a decimal number, which can be converted to binary to determine the setting of the Event Summary Status Enable Register.

**Table 4-4. Event Summary Status Register, Bit Evaluation**

| Bit Number | Mnemonic | Description |
|---|---|---|
| 0 | OPC | **Operation Complete** - This bit is set on completion of operation that has been designated by the *OPC command. |
| 3 | DDE | **Device-Dependent Error** - Set when a hardware error occurs within the receiver. |
| 4 | EXE | **Execution Error** - Set when an out of range data element follows a known message header or when a valid message could not be executed due to some device condition. |
| 5 | CME | **Command Error** - Set when an unrecognized message header has been received. |
| 7 | PON | **Power On** - Set during the power-up sequence. Also set when a Device or Select Device Clear is received. |

### 4.6.3 RECEIVER STATUS REGISTER

The Receiver Status Register allows for interrupts to be generated when particular operational events occur. The information in this register discloses the reason for the RSB bit to be set in the Status Byte Register. The *RSR? query reads the latched contents of this register and clears it. It is also cleared by *CLS. See **Table 4-5** for the bit evaluation of the Receiver Status Register.

**Table 4-5. Receiver Status Register, Bit Evaluation**

| Bit | Decimal Value | Function |
|---|---|---|
| 0 | 1 | PRS, signal exceeded SQL threshold. This is an edge triggered event on the action of a signal going from below SQL threshold to above SQL threshold. This bit is only set while in a scan mode (F1→F2, F1→F2 w/Lock, or Channel). |
| 1 | 2 | Not used |
| 2 | 4 | Not used |
| 3 | 8 | Not used |
| 4 | 16 | ESN, end of scan. This bit indicates the end of scan has been encountered. This bit is only set while in a scan mode (F1→F2, F1→F2 w/Lock, or Channel). |
| 5 | 32 | Not used |
| 6 | 64 | Not used |
| 7 | 128 | Not used |

### 4.6.4 DEVICE-DEPENDENT ERROR REGISTER

The contents of the Device-Dependent Error Register can be read to determine what event has caused the DDE bit in the Event Status Register to be set. The CDE? and LDE? queries are used as further discussed below.

The LDE? query request the latched error status. The response is a bit-mapped 16-bit word indicating the error conditions that have occurred since the last read of the register. Reading the contents of the register also clears it. See **Table 4-6** for a bit evaluation of the Device-Dependent Error Register.

The CDE? query request the current device error. The response to this query is also a bit-mapped 16-bit word as detailed in **Table 4-6.** Reading this register has no effect on it.

**Table 4-6. Device-Dependent Error Register, Bit Evaluation**

| Bit | Decimal Value | Mnemonic | Description |
|---|---|---|---|
| 0 | 1 | DSP ERR 1 | Control to DSP transmit pipeline not empty. |
| 1 | 2 | DSP ERR 2 | Control to DSP download unsuccessful. |
| 2 | 4 | DSP ERR 3 | DSP EPROM download unsuccessful. |
| 3 | 8 | DSP ERR 4 | Control command not acknowledged by DSP. |
| 4 | 16 | DSP ERR 5 | No DSP response to Control request. |
| 5 | 32 | Not Used | |
| 6 | 64 | PS ERR 1 | -12 Volt Supply Low. |
| 7 | 128 | PS ERR 2 | +12 Volt Supply Low. |
| 8 | 256 | BATT ERR | Battery Voltage Low. |
| 9 | 512 | LO ERR | Local Oscillator Unlocked. |
| 10 | 1024 | REF ERR | Unknown External Reference. |
| 11 | 2048 | RAM FAIL | Control Processor RAM Failure. |
| 12 | 4096 | CHKSUM | EPROM Checksum Error. |
| 13 | 8192 | PRESEL OVRLD | Preselector Overload (when the WJ-8712/PRE option is installed). |
| 14 | 16384 | Not Used | |
| 15 | 32768 | Not Used | |

## 4.7 MESSAGE PROCESSING

When the WJ-8712 receives a remote message, it stores it in an input buffer circuit until it receives a valid message terminator (LF). When the terminator is received, the message is parsed and executed.

The format of the received message is checked for validity as the message is parsed and executed. If the message fails to meet the restrictions of the command message format, it is ignored.

## 4.8 RS-232 COMMUNICATIONS PROTOCOL

The communications protocol for the WJ-8712 implements both ENQ/ACK (ENQuire/ACKnowledge) and XON/XOFF (ctl Q/ctl S) software handshakes. The ENQ/ACK format, typically referred to as "transmitter protocol", allows the operator to send an "ENQ" character to the WJ-8712 when an acknowledge is required. The receiver then responds with the ACK/NAK (ACKnowledge/Not AcKnowledge) character indicating the validity of the data received in the input buffer and the fact the unit has completed all current data through to the last received terminator. The XON/XOFF format supports both transmit and receive communications. This format, typically referred to as "receiver protocol", allows transmission based on the availability of buffer space (refer to **paragraph 4.8.3**).

**Table 4-7** lists the supported communications control commands for RS-232 remote operation. The following paragraphs provide more details on the ENQ/ACK and XON/XOFF protocol, and buffer control.

**Table 4-7. Supported RS-232C Communications Control Commands**

| HEX | ASCII | Receive | Transmit | Function |
|---|---|---|---|---|
| 11 | DC1 | x | x | XON, allow data transmission |
| 13 | DC3 | x | x | XOFF, disallow data transmission |
| 05 | ENQ | x | | Enquire, request acknowledge |
| 06 | ACK | | x | Acknowledged, data received |
| 15 | NAK | | x | Not acknowledged, data communications error |
| 0A | LF | x | x | Line feed, start processing input buffer |
| 0D | CR | x | x | Carriage return, no action |

### 4.8.1 XON/XOFF PROTOCOL

The XON/XOFF communications protocol is always active in the WJ-8712. In the event the buffer has room for less than 16 additional characters the unit will output an XOFF character. When the unit empties its input buffer, it issues an XON character. The user must stop sending data within 15 characters after receiving the XOFF character. On each character that is received while the buffer is full, the unit issues an XOFF character. The user may start sending data to the unit after receiving the XON character.

The WJ-8712 responds to the XON and XOFF commands while outputting data to the user. If the unit receives an XOFF while sending, it stops transmitting within two characters. The unit will not transmit any further data until an XON is received. The WJ-8712 assumes the XON condition at power-up.

### 4.8.2 ENQ/ACK PROTOCOL

When the ENQ character is sent to the WJ-8712, it responds to a valid message with an ACK, or to an invalid message with a NAK. An invalid message is indicated on a data communications error such as framing, noise, or overrun. The transmission of a NAK indicates that one or more of the bytes received after the last ENQ has a communications error. The ACK/NAK response is only sent after the unit has completed processing any previous messages in the input buffer and has output any response necessary. See **Table 4-7.**

WJ-8712 internally maintains a communications error flag. The flag is cleared on power-up or the transmission of a NAK. The flag is set when a byte is received with a data communications error. Upon receiving an ENQ character, the unit responds with an ACK/NAK based on the condition of the communications flag, after any pending input and output operations are complete.

### 4.8.3 BUFFER HANDLING

#### 4.8.3.1 Input Buffer

The input buffer is handled in circular fashion allowing simultaneous inputting and processing of data. The input buffer accepts up to 1024 bytes before overflowing. As data in the buffer is being processed, additional inputs can be accepted by the unit. Upon receiving a terminator character, the WJ-8712 processes any previous messages in the buffer. When the buffer has less than 16 unused bytes, XOFF is generated. XON is generated when the buffer has less than 16 bytes remaining to be processed.

The input buffer processing starts on the receipt of a terminator (LF). If the communications error flag is set, the buffer contents from the end of the last processed message thru the message terminator is discarded. In the event the buffer is overrun, its contents are discarded. Messages such as XON, XOFF, and ENQ have immediate actions. These commands are processed on receipt and are not buffered. All other incoming data is buffered and processed in the order in which it was received.

#### 4.8.3.2 Output Buffer

The output buffer is handled in circular fashion allowing simultaneous additions and outputting. The transmission of XON/XOFF has priority over data in the output buffer that is awaiting transmission. The ACK/NAK transmission are buffered operations so they stay in time synchronization with query operations. The output buffer holds up to 1024 bytes of data.

# SECTION V

# CSMA REMOTE CONTROL

# SECTION V

# CSMA REMOTE CONTROL

## 5.1 INTRODUCTION

This section provides information for remotely controlling the WJ-8712 Digital HF Receiver on a CSMA/CD type of interface. CSMA/CD, or Carrier Sense/Multiple Access with Collision Detection (hereafter referred to as simply CSMA), is a media access method that allows two or more stations (up to 63) to share a common bus medium. To transmit, a station waits (defers) for a quiet period on the medium (that is, no other station is transmitting) and then sends the intended message in bit-serial form. If, after initiating a transmission, the message collides with that of another station, then each transmitting station intentionally sends a few additional bytes to ensure propagation of the collision throughout the system. The station remains silent for a random amount of time (backoff) before attempting to transmit again.

The WJ-8712 can be set for CSMA remote control by setting DIP switches A2S1 and A2S2. Switch 4 of DIP switch A2S1 can be set to the on (down) position to activate the CSMA remote control. Baud rate hardware default can also be selected. The CSMA address hardware default can be selected with switch A2S2. The tuned frequency format can be set to four bytes or five bytes with A2S2. Refer to **paragraph 2.2.5** for details on configuring DIP switches A2S1 and A2S2.

The following receiver parameters are controllable via the CSMA interface:

- remote control, or remote control with local lockout,
- tuned frequency,
- BFO frequency,
- detection mode,
- IF bandwidth,
- gain mode,
- manual gain, and
- RF input path.

This section of the manual contains information necessary to enable an operator to control and monitor the above receiver parameters from an external controller on the CSMA interface. Details on how to properly format and transmit remote messages and how to read responses from the receiver are provided.

Before attempting to operate the receiver remotely, it is recommended that the operator become familiar with the operation of the controller by viewing its literature.

## 5.2 ELECTRICAL REQUIREMENTS OF THE INTERFACE

**Figure 5-1** shows the circuitry of the CSMA interface in the WJ-8712. The interface is implemented on a mini-phones jack (A2J2) located on the rear panel, labeled CSMA. The sleeve of this connector is connected to chassis ground. The center conductor carries the bidirectional serial data line. For proper communications on the interface, a logic HIGH input should be +2 volts minimum. A logic LOW input should be +0.7 volts maximum. These logic levels are compatible with standard TTL and 5 volt CMOS logic drivers. With appropriate level shifting circuitry, any computer equipped with an RS-232C interface port can be used to control the WJ-8712 via its CSMA interface. To reduce the adverse effects of reflections on the line, resistive terminations are recommended on each end of the interface cable. The DC bias introduced by the terminations must exceed +2.5 volts. A single resistor at each end of the cable, connected between a clean +3 to +5 volt supply and the data line, is usually adequate. Be sure that all devices connected to the CSMA interface have sufficient drive capability to transmit data onto the line. The WJ-8712 CSMA port can sink up to 100 mA at a logic low output voltage of +0.7 volts.

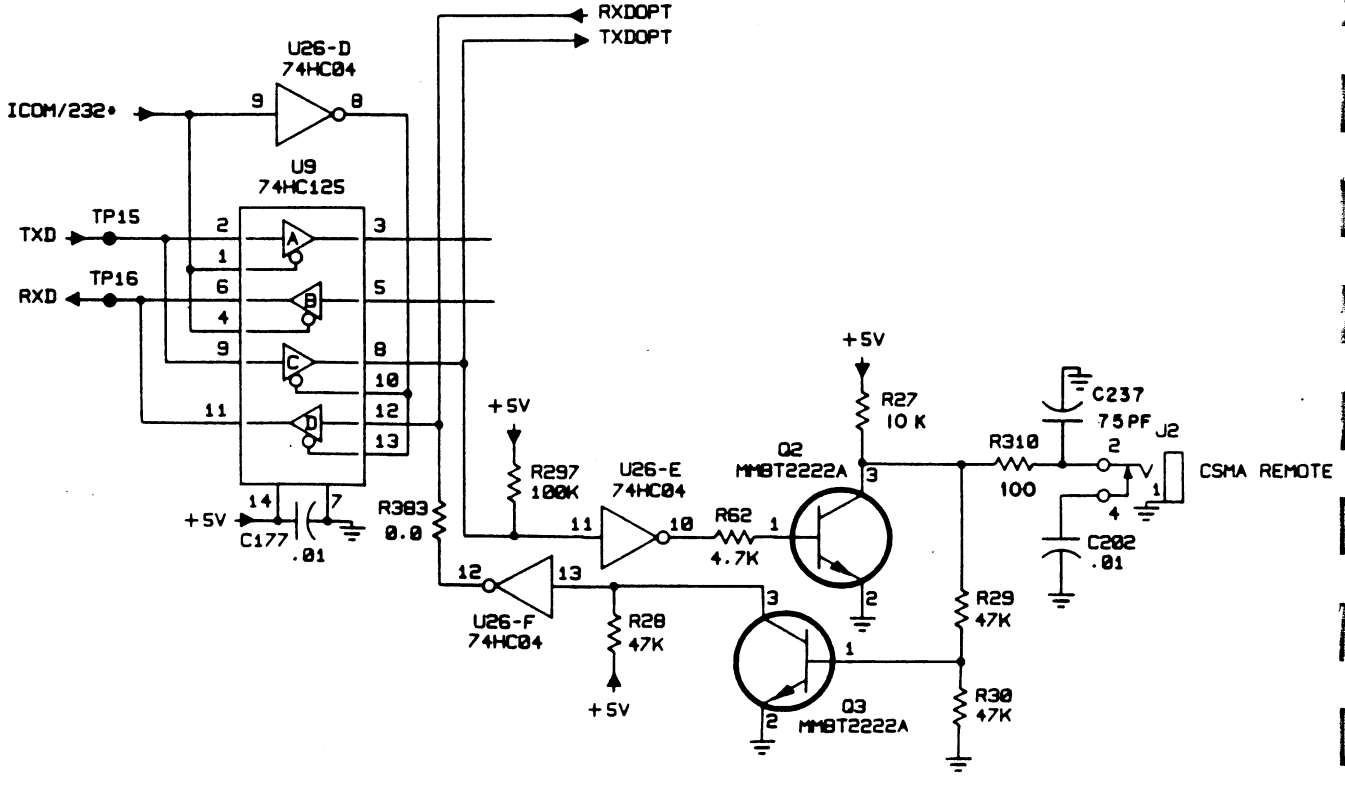



**Figure 5-1. CSMA Interface Circuit**

## 5.3 SERIAL DATA TRANSMISSIONS

Data in serial transmissions is read from the transition of the change in state (i.e., high to low, or low to high). Data transmitters and data receivers connected on the interface exchange serial information using the NonReturn to Zero (NRZ) format. This means, in baseband transmissions, if a logic "1" is continuously sent the signal does not return to logic "0" until a logic "0" is sent. The composition of one byte of data is shown in **Figure 5-2** with an example of the NRZ format.

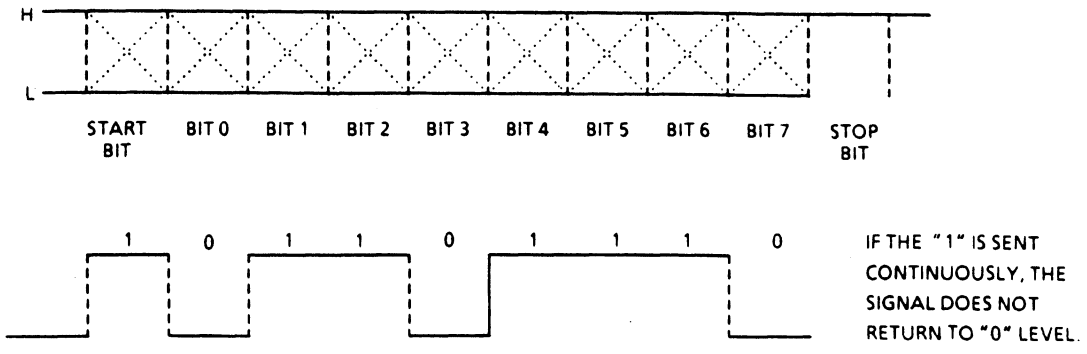



**Figure 5-2. Composition of One Byte of Serial Data**

## 5.4 COMMAND MESSAGE FORMATTING

The typical command message format used with this interface is provided in **Figure 5-3.** Each block in the packet contains one byte of data. As shown in the figure the packet consists of two preamble bytes, a receiving station address byte, a transmitting station address byte, a control code byte, variable length data bytes, and an end of message byte. All information contained in bytes is expressed in hexadecimal except for variable length data bytes which are expressed in packed binary coded decimal (BCD).

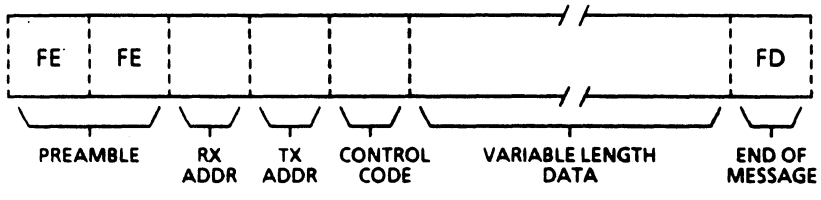



**Figure 5-3. Typical Command Message Format**

The preamble [FE|FE] identifies the start of a message. The receiving station address (RX ADDR) identifies the address of the unit that is to receive the data. The WJ-8712's address setting should be entered at this location. The transmitting station address identifies the address of the controller sending the data. The control code represents the WJ-8712 function that is to be controlled. This code should always be sent in hexadecimal format. The variable length data field contains data that accompanies the control code to set certain values of the function. This data field can contain any number of bytes required to send the data. Data in these bytes should always be sent in binary coded decimal format. The end of message byte [FD] identifies the end of the message being transmitted.

## 5.5 CONTROL CODES

**Table 5-1** lists the control codes used for controlling the receiver functions. The control codes listed are shown in hexadecimal format. A description is provided for each control code. Data accompanying control codes is shown in packed binary coded decimal format.

Certain control codes require an acknowledgement from the host controller that their format was valid and accepted. For all control codes that require an acknowledgment, hexadecimal FB (ACK) is returned to the controller when the control code is recognized and the accompanying data is within the specified range. Hexadecimal FA (NAK) is returned to the controller if either the control code sent is unsupported or if the accompanying data sent with a supported control code is out of range. Note that unless otherwise indicated the control code requires an acknowledge.

**Table 5-1. CSMA Control Codes**

| Control Code (Hexadecimal) | Description (Packed BCD) |
|---|---|
| 00 | Set the tuned frequency in Hz without acknowledge.<br>Range: 00000000 - 30000000 |
| 01 | Set the detection mode (first data byte) and IF bandwidth (second data byte) without acknowledge.<br>Where: 00 - LSB<br>01 - USB<br>02 - AM<br>03 - CW<br>05 - FM<br>06 - ISB<br><br>And: 01 - 0.30 kHz<br>02 - 1.00 kHz<br>03 - 3.20 kHz<br>04 - 6.00 kHz<br>05 - 16.0 kHz |
| 02 | Request the tuned frequency range. |
| 03 | Request the tuned frequency. |
| 04 | Request the selected detection mode and IF bandwidth. |
| 05 | Set the tuned frequency in Hz with acknowledge.<br>Range: 00000000 - 30000000 |

**Table 5-1. CSMA Control Codes** (Continued)

| Control Code (Hexadecimal) | Description (Packed BCD) |
|---|---|
| 06 | Set the detection mode (first data byte) and IF bandwidth (second data byte) with acknowledge.<br>Where: 00 - LSB<br>01 - USB<br>02 - AM<br>03 - CW<br>05 - FM<br>06 - ISB<br><br>And: 01 - 0.30 kHz<br>02 - 1.00 kHz<br>03 - 3.20 kHz<br>04 - 6.00 kHz<br>05 - 16.0 kHz<br><br>Note: The ISB, LSB, or USB detection modes will force the unit into the 3.20 kHz IF BW. |
| 30 | Request active gain control mode. |
| 31 | Select gain control mode with acknowledge.<br>Where: 00 - Manual<br>01 - Slow AGC<br>02 - Fast AGC |
| 32 | Request the remote manual gain level. |
| 33 | Set the remote manual gain level with acknowledge.<br>Range: 0000 - 0127 |
| 34 | Request current BFO frequency. |
| 35 | Set BFO frequency in Hz (in 10 Hz steps) with acknowledge. The third data byte contains the sign in hexadecimal (0E for negative and 0A for positive).<br>Range: -8000 to +7999<br>Where: +0000 = BFO Off |
| 36 | Request the device control mode. |
| 37 | Set the device control mode with acknowledge.<br>Range: 00 - 02<br>Where: 00 - Local<br>01 - Remote<br>02 - Remote w/Local Lockout |
| 38 | Request the selected RF input path. |
| 39 | Select the RF input path with acknowledge.<br>Range: 01 - 03<br>Where: 01 - Normal<br>02 - Attenuated<br>03 - Preamplified |

## 5.6 DETAILS ON COMMAND AND RESPONSE FORMATS

The following paragraphs provide examples of command and response formats for each control code listed in **Table 5-1.** In the examples, the receiver's address is assumed to be hexadecimal 1A (decimal 26) and the controller's address is assumed to be hexadecimal F1 (decimal 241). It is also assumed that the tuned frequency format is set to four bytes with A2S2 **(paragraph 2.2.5).**

### 5.6.1 TUNED FREQUENCY COMMAND WITHOUT ACKNOWLEDGE [00]

**Figure 5-4** shows an example of the typical format for setting the receiver's tuned frequency using control code [00]. This control code does not require an acknowledgement.

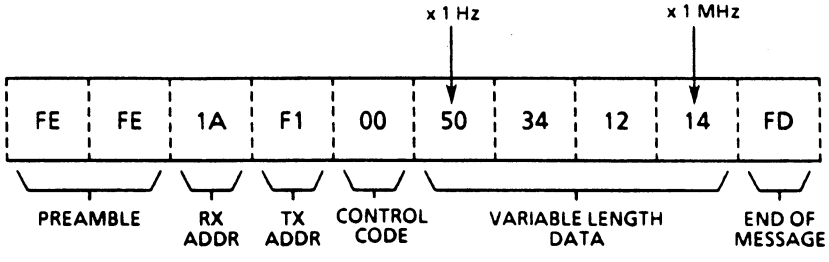



**Figure 5-4. Tuned Frequency Command Format without Acknowledge**

The frequency can be set to any value from 0 to 30.0 MHz at a resolution of 1 Hz. The frequency entered in the example is 14.123450 MHz. The first byte of the frequency data contains Hz data. The last (fourth) byte contains MHz data. If less than four bytes accompany the frequency control code, only those lower resolution value are changed and the higher resolution values (bytes not sent) remain the same.

### 5.6.2 TUNED FREQUENCY COMMAND WITH ACKNOWLEDGE [05]

**Figure 5-5** shows an example of the typical format for setting the receiver's tuned frequency using control code [05]. This control code requires an acknowledgement from the controller.

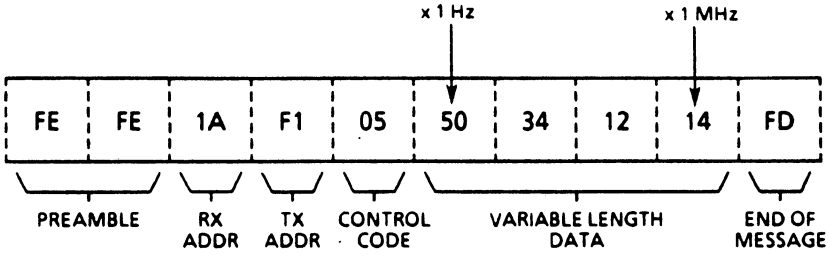



**Figure 5-5. Tuned Frequency Command Format with Acknowledge**

The frequency can be set to any value from 0 to 30.0 MHz at a resolution of 1 Hz. The frequency entered in the example is 14.123450 MHz. The first byte of the frequency data contains Hz data. The last (fourth) byte contains MHz data. If less than four bytes accompany the frequency control code, only those lower resolution value are changed and the higher resolution values (bytes not sent) remain the same.

### 5.6.3 RESPONSE TO TUNED FREQUENCY REQUESTS [03]

**Figure 5-6** shows an example of the typical response format when requesting the tuned frequency with control code [03].

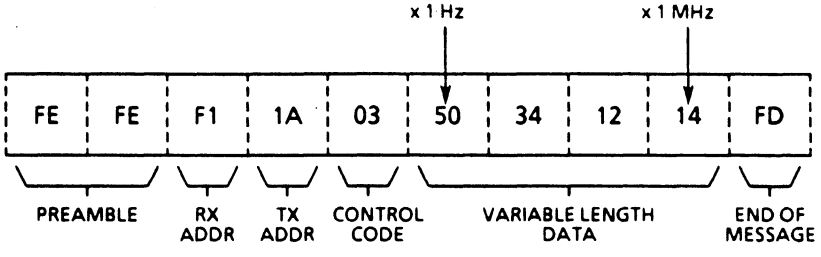



**Figure 5-6. Tuned Frequency Request Response Format**

The response in the example is 14.123450 MHz. The first byte of the frequency data contains Hz data. The last (fourth) byte contains MHz data. The response always contains all four bytes of the frequency data.

### 5.6.4 RESPONSE TO TUNED FREQUENCY RANGE REQUESTS [02]

**Figure 5-7** shows an example of the typical response format when requesting the tuned frequency range of the receiver with control code [02].

In the response the upper frequency limit and the lower frequency limit is separated with 2D hex. The first byte of the frequency data in each limit in the response contains Hz data. The last (fourth) byte contains MHz data. The upper frequency limit response always contains data representing 30.000000 MHz [00|00|00|30]. The lower frequency limit response always contains data representing 0 Hz [00|00|00|00].

### 5.6.5 DETECTION MODE/IF BANDWIDTH COMMAND WITHOUT ACKNOWLEDGE [01]

**Figure 5-8** shows an example of the typical format for selecting the receiver's detection mode and IF bandwidth using control code [01]. This control code does not require an acknowledgement.

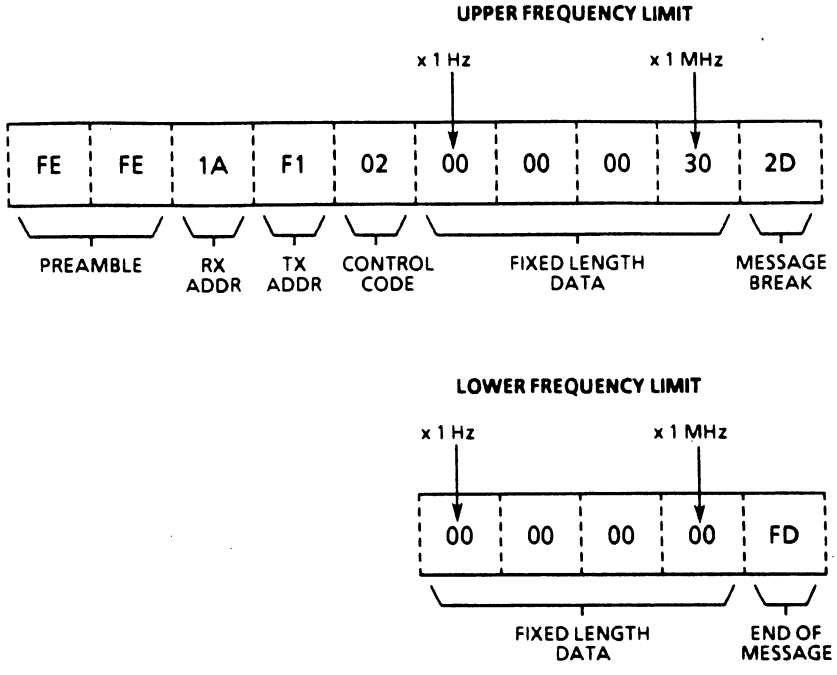



**Figure 5-7. Tuned Frequency Range Request Response Format**

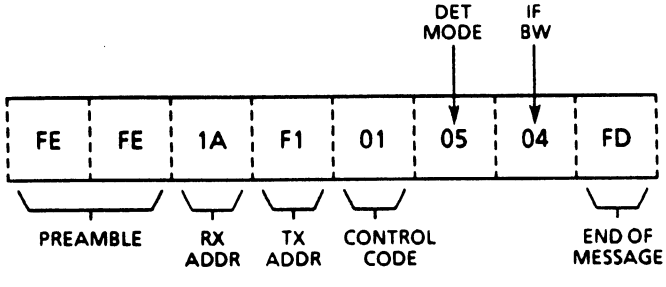



**Figure 5-8. Detection Mode/IF Bandwidth Command Format Without Acknowledge**

The first byte after the control code contains the detection mode code. The second byte contains the IF bandwidth code. See control code [01] in **Table 5-1** for the detection mode and IF bandwidth choices and their codes. In the example, the FM detection mode is selected with an IF bandwidth of 6.00 kHz. The IF bandwidth byte is ignored when the detection mode byte contains codes for LSB, USB, or ISB detection modes ([00], [01], or [06]). When these detection modes are selected, the IF bandwidth is automatically set to 3.2 kHz [03].

### 5.6.6 DETECTION MODE/IF BANDWIDTH COMMAND WITH ACKNOWLEDGE [06]

**Figure 5-9** shows an example of the typical format for selecting the receiver's detection mode and IF bandwidth using control code [06]. This control code requires an acknowledgement from the controller.

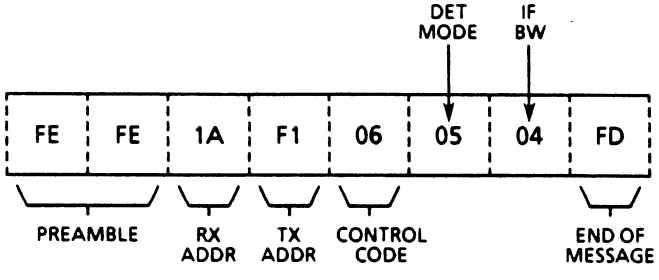



**Figure 5-9. Detection Mode/IF Bandwidth Command Format With Acknowledge**

The first byte after the control code contains the detection mode code. The second byte contains the IF bandwidth code. See control code [06] in **Table 5-1** for the detection mode and IF bandwidth choices and their codes. In the example, the FM detection mode is selected with an IF bandwidth of 6.00 kHz. The IF bandwidth byte is ignored when the detection mode byte contains codes for LSB, USB, or ISB detection modes ([00], [01], or [06]). When these detection modes are selected, the IF bandwidth is automatically set to 3.2 kHz [03].

### 5.6.7 RESPONSE TO DETECTION MODE/IF BANDWIDTH REQUESTS [04]

**Figure 5-10** shows an example of the typical response format when requesting the receiver's detection mode and IF bandwidth with control code [04].

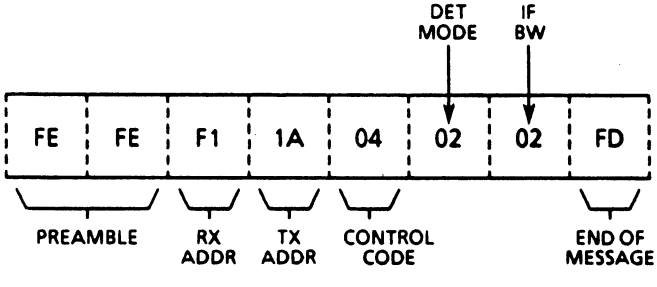



**Figure 5-10. Detection Mode/IF Bandwidth Request Response Format**

The first byte in the response contains the detection mode code and the second byte contains the IF bandwidth code. The response in the example is the AM detection mode with an IF bandwidth of 1.00 kHz. See control code [01] or [06] in **Table 5-1** for the possible responses for both bytes.

### 5.6.8 GAIN CONTROL MODE COMMAND WITH ACKNOWLEDGE [31]

**Figure 5-11** shows an example of the typical format for selecting the receiver's gain control mode using control code [31]. This control code requires an acknowledgement from the controller.

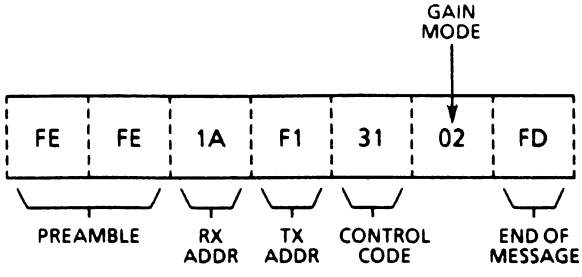



**Figure 5-11. Gain Control Mode Command Format**

One byte is sent with the control code. In the example, the fast AGC control mode is selected [02]. The selection can also be either slow AGC [01] or manual gain control [00].

### 5.6.9 RESPONSE TO GAIN CONTROL MODE REQUESTS [30]

**Figure 5-12** shows an example of the typical response format when requesting the receiver's active gain control mode with control code [30].

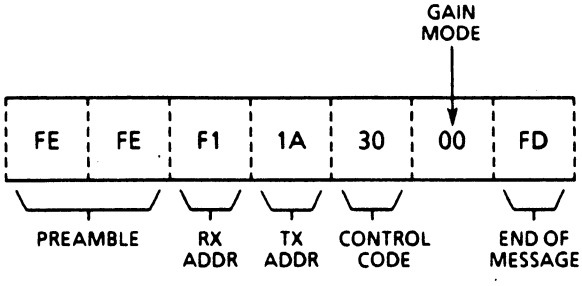



**Figure 5-12. Gain Control Mode Request Format**

The byte in the response after the control code contains the gain control code. The response in this byte is [00] for manual gain, [01] for slow AGC, or [02] for fast AGC. In the example, manual gain control is the response.

### 5.6.10 MANUAL GAIN LEVEL COMMAND WITH ACKNOWLEDGE [33]

**Figure 5-13** shows an example of the typical format for selecting the receiver's manual gain level using control code [33]. This control code requires an acknowledgement from the controller.

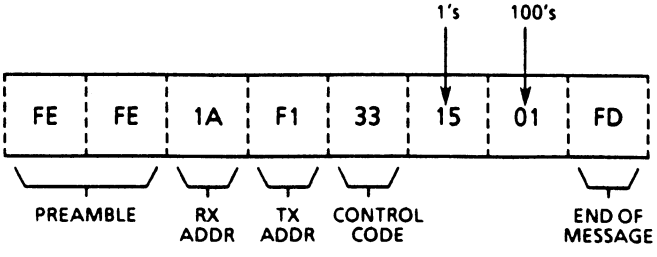



**Figure 5-13. Manual Gain Level Command Format**

Two bytes are sent with the control code, with the combination of both representing the value. The range is 0000 to 0127 (for 0 to 127 dB). In the example, a manual gain level of 115 dB is selected [15|01].

### 5.6.11 RESPONSE TO MANUAL GAIN LEVEL REQUESTS [32]

**Figure 5-14** shows an example of the typical response format when requesting the receiver's manual gain level with control code [32].

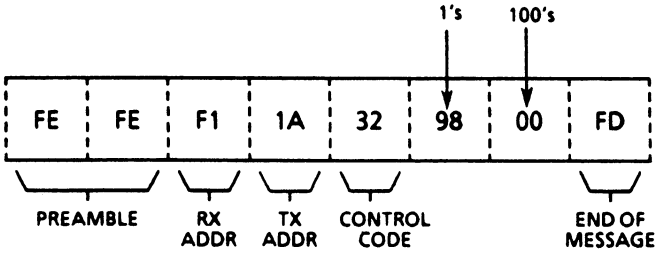



**Figure 5-14. Manual Gain Level Request Format**

Two bytes in the response following the control code contain the current manual gain level. The combination of the two bytes represent the value in binary coded decimal. The value can be from 0000 to 0127 (or 0 to 127 dB). In the example, the manual gain level response is 98 [98|00].

### 5.6.12 BFO FREQUENCY COMMAND WITH ACKNOWLEDGE [35]

**Figure 5-15** shows an example of the typical format for sending the receiver's BFO frequency using control code [35]. This control code requires an acknowledgement from the controller.

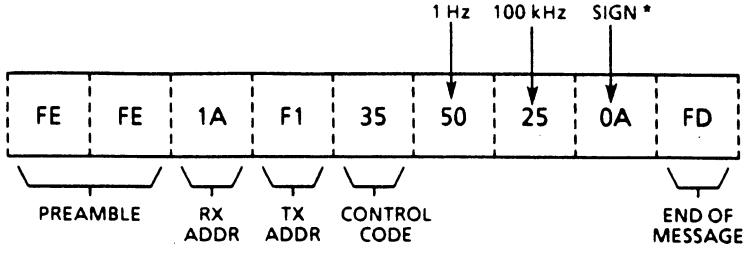



**Figure 5-15. BFO Frequency Command Format**

The frequency can be set to any value from +7999 to -8000 kHz at a resolution of 10 Hz. Sending +0000 sets the BFO to off. The frequency entered in the example is +2.550 kHz. The first byte of the frequency data contains Hz data. The second byte contains 100-Hz data. The third byte contains the sign, positive (+) or negative (-). For negative BFO frequencies, a hexadecimal value of [0E] should be sent in the third byte. For positive BFO frequencies, a hexadecimal value of [0A] should be sent in the third byte.

### 5.6.13 RESPONSE TO BFO FREQUENCY REQUESTS [34]

**Figure 5-16** shows an example of the typical response format when requesting the BFO frequency with control code [34].

The response in the example is -855 Hz. The first byte of the frequency data contains Hz data. The second byte contains 100-Hz data. The third byte contains the sign, positive (+) or negative (-). A value of [0E] is returned in the third byte of the response when the frequency is a negative value. A value of [0A] is returned when the BFO frequency is positive.

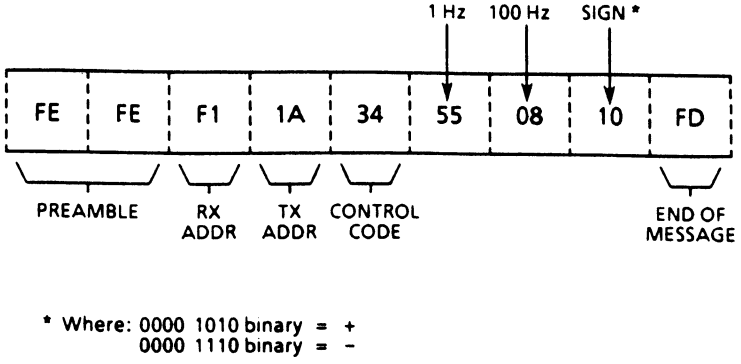



**Figure 5-16. BFO Frequency Request Response Format**

### 5.6.14 RF INPUT PATH COMMAND WITH ACKNOWLEDGE [39]

**Figure 5-17** shows an example of the typical format for selecting the receiver's RF input path using control code [39]. This control code requires an acknowledgement from the controller.

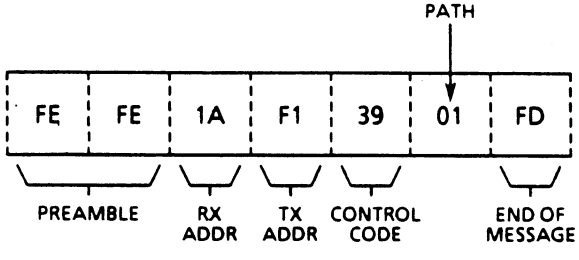



**Figure 5-17. RF Input Path Command Format**

One byte is sent with the control code. In the example, the normal RF input path is selected [01]. The selection can also be either attenuated [02] or preamplified [03].

### 5.6.15 RESPONSE TO RF INPUT PATH REQUESTS [38]

**Figure 5-18** shows an example of the typical response format when requesting the receiver's current RF input path selection with control code [38].

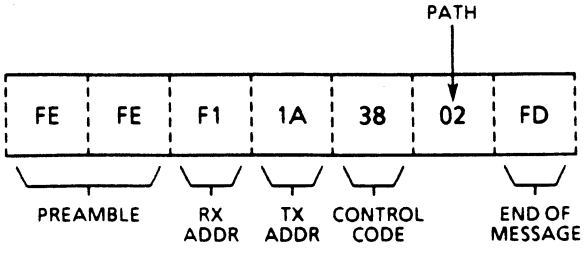



**Figure 5-18. RF Input Path Request Response Format**

The byte in the response after the control code contains the RF input path code. The response in this byte is [00] for normal, [01] for attenuated, or [02] for preamplified. In the example, the attenuated RF input path is selected.

### 5.6.16 DEVICE CONTROL MODE COMMAND WITH ACKNOWLEDGE [37]

**Figure 5-19** shows an example of the typical format for selecting the receiver's control mode using control code [37]. This control code requires an acknowledgement from the controller.

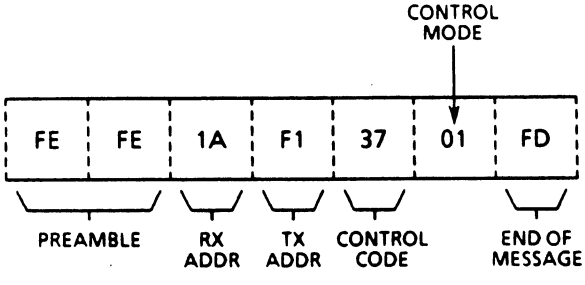



**Figure 5-19. Device Control Mode Command Format**

One byte is sent with the control code. The remote control mode is selected [01].

### 5.6.17 RESPONSE TO DEVICE CONTROL MODE REQUESTS [36]

**Figure 5-20** shows an example of the typical response format when requesting the receiver's current control mode with control code [36].

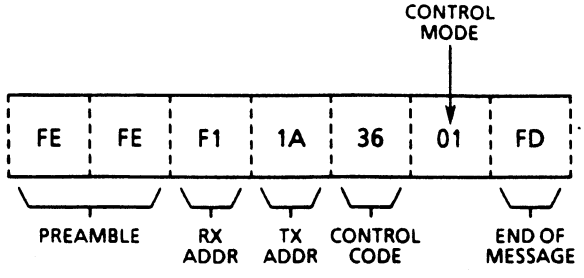



**Figure 5-20. Device Control Mode Request Response Format**

The byte in the response after the control code contains the device control mode code. The response in this byte is [01] for Remote.

## 5.7 COLLISION DETECTION

Many different data transmitting devices can be connected on the interface along with the WJ-8712. Therefore, there is always the possibility that two or more units may want to talk at the same time, causing "data collisions" on the interface.

The design of this interface is such that each device can compare what it sent to what it is receiving on the interface. That is, it receives everything that it sends simultaneously. If the receive data does not match the send data, then a collision has occurred. The data transmitting device then waits until the interface is idle and sends the jammer code shown in **Figure 5-21.**

The data transmitting device checks again for an idle interface, then sends the original message. If another collision occurs, the process is repeated until the message goes through or until the fifth repetition. After five tries, the data transmitting device discards the message. Only transmitting a new message will start the process again. If the data receiving device detects the jammer codes, the data which it receives is canceled.


**Figure 5-21. Jammer Code**

# SECTION VI

# CIRCUIT DESCRIPTION

# SECTION VI

# CIRCUIT DESCRIPTION

## 6.1 WJ-8712 DIGITAL HF RECEIVER FUNCTIONAL DESCRIPTION

The WJ-8712 Digital HF Receiver is a Digital Signal Processing (DSP) based receiver, consisting of an analog tuner, an IF digitizer, digital signal processing circuitry, and analog reconstruction. These operating components, and the receiver control circuitry, are contained on two printed circuit assemblies, consisting of the Type 797006 RF Assembly (A3) and the Type 797012 Digital Assembly (A2). These two assemblies, along with the Power Supply, and the Power Distribution circuit comprise the complete DSP based HF Receiver, as illustrated in **Figure 6-1.** Refer to the functional block diagram in **Figure 6-1** for the following functional description.

The Type 797006 RF Assembly (A3) functions as the analog tuner for the receiver. It performs coarse signal tuning and provides two wide band IF output signals. Three conversion stages contained in this assembly provide tuning throughout the 5 kHz to 30.0000 MHz spectrum, with a coarse tuning resolution of 1 kHz. The RF input from the antenna enters the assembly at the rear panel RF INPUT connector (A3J1) and, after passing through the three conversion stages, the tuned signal is translated into two IF outputs. The first output is a 455 kHz IF output, having a 30 kHz bandwidth. It is routed directly to the rear panel Signal Monitor Output connector (SMO, A3J2). This is a 50 ohm wide band output suitable for connection of an external signal monitor. The second output is a 25 kHz IF output, also having a 30 kHz bandwidth, that is routed to the Type 7970012 Digital Assembly (A2) for digitizing and further processing. In addition to the 25 kHz IF signal, the RF Assembly provides two clock signals to the Digital Assembly. The 40 MHz and 430 kHz signals, derived from the receiver's local oscillators, are used for signal processing synchronization and analog reconstruction.

Timing and synchronization of the local oscillators in the RF Assembly are maintained by a precision 10 MHz reference contained on the assembly. In the standard receiver, the internal reference provides a reference stability of better than 0.7 ppm, which may be optionally upgraded to 0.1 ppm with the 8712/REF option installed. The RF Assembly reference may also be locked to an external frequency standard by connecting the external 1, 2, 5, or 10 MHz signal at the rear panel EXTERNAL REFERENCE connector (A3J3). The connection of the external reference in automatically sensed and locks the reference oscillator to the external source.

The Type 797012 Digital Assembly (A2) functions as the IF Digitizer, Digital Signal Processor, and Analog Reconstruction circuit for the receiver. It also contains the microcontroller circuitry that maintains control over all receiver operations. The Digital Assembly accepts the 25 kHz IF signal from the RF Assembly, digitizes the signal, and using Digital Signal Processing (DSP) techniques, performs the majority of the signal processing operations required to produce the final outputs. The DSP circuitry on this assembly converts the digitized IF signal from a continuous time domain signal into discrete time samples that can be stored in random access memory and processed digitally to perform a wide range of operations, normally associated with analog circuitry, such as:

- Receiver Fine Tuning to a 1 Hz resolution,
- IF Bandpass Filtering,
- Determination of Input Signal Strength,
- Receiver Gain Control,
- Signal Detection and Demodulation,
- Noise Blanking.

Upon completion of the signal processing, a serial data stream representing the receiver's bandpass filtered IF signal, and the demodulated audio extracted from the tuned signal are routed to the Analog Reconstruction circuitry. The Analog Reconstruction circuitry converts the digital data back to its analog form, separates the audio and IF signals, provides post filtering, and, after completion of the analog reconstruction, provides the final audio and post filtered IF outputs. The reconstructed IF signal is converted up to 455 kHz and is provided the rear panel IF OUTPUT connector (A2J1) for external use. This 50 ohm output provides the 455 kHz IF at a level of approximately -20 dBm (AG active), with its bandwidth determined by the operator selected IF bandwidth.

The reconstructed audio is separated into left and right channels and is then directed to the various receiver audio outputs. The phone audio is routed to the front panel PHONES jack (A1J1) via the Power Distribution Assembly (A1). The audio signal is also provided to the rear panel terminal bus (TB1). The LINE A and LINE B audio outputs are 600 ohm balanced audio outputs, and the SPEAKER output is an unbalanced 8 ohm output. The final audio output is the DC AUDIO, a DC coupled, unbalanced, 1k ohm output.

The Type 797012 Digital Assembly also contains a microcontroller that provides an interface between an external controlling device and the receiver circuitry. Two serial control interfaces are provided to the rear panel to permit receiver control by either an RS-232 or CSMA compatible computer via A2J3 or A2J2, respectively. A third control interface, routed to the receiver front panel (CONTROL INTERFACE, W3J1), permits the connection of a Type TF-30387 8712 Front Panel Controller Test Fixture (not supplied). With the test fixture installed, complete receiver control is provided using the controls and indicators of the test fixture.

Operating power is supplied to all of the assemblies in the WJ-8712 Receiver by the Type 841704 or 841792 Power Supply (PS1). This assembly accepts the incoming line voltage and converts it to the DC voltages required for proper receiver operation. It accepts an AC input ranging between 97 and 253 VAC and provides the PWRFAIL*, -12 V, +12 V, GND, and +5 V outputs to the operational assemblies, via the Power Distribution Assembly.

The Type 383076 Power Distribution Assembly (A1) distributes power to all of the operating circuitry of the receiver via the Digital Assembly, provides power to the rear panel fan (B1), and to the front panel POWER indicator light (S1D1). It also provides an interface between the front panel and the Digital Assembly for the headphone jack and the phone audio gain control.

## 6.2 CIRCUIT DESCRIPTIONS

### 6.2.1 TYPE 797006 RF ASSEMBLY, (A3)

This assembly is manufactured in four versions. The Type 797006-1 is the standard assembly. It is equipped with the standard reference generator, having a stability of better than 0.7 ppm. The Type 797006-2 version is installed in receivers containing the WJ-871Y/REF option. This version is equipped with an upgraded reference generator, having a stability of better than 0.1 ppm.

The Type 797006-3 and Type 797006-4 assemblies are conformal coated versions of the RF Assembly. The Type 797006-3 is a conformal coated version of the standard assembly. It is installed in receivers containing the WJ-8712/ENV option. The Type 797006-4 is a conformal coated version of the upgraded 0.1 ppm stability assembly. It is installed in receivers containing both the WJ-871Y/REF and WJ-8712/ENV options.

The Type 797006 RF Assembly (A3) functions as the RF tuner for the WJ-8712 Digital HF Receiver. It receives a 500 kHz to 30.0000 MHz input spectrum from the RF signal source and provides RF tuning to extract the signal of interest from the input spectrum. The signal of interest is converted to 455 kHz and 25 kHz IF signals that are provided as outputs for further processing. Refer to the Type 797006 RF Assembly Block Diagram in **Figure 6-2** as a reference for the following module description. For a more detailed illustration of the RF Assembly circuitry, refer to the Type 797006 RF Assembly schematic diagram, **Figure 9-2.**

The RF Assembly consists of an RF Input circuit, three Mixing stages for signal conversion, a highly stable reference generator, and three local oscillators. These module sections interconnect as illustrated in **Figure 6-2** to produce the required outputs.

The reference generator uses a phase-locked-loop synthesizer to control a temperature compensated, voltage controlled crystal oscillator, producing a highly stable 10 MHz reference signal that is used as the time base for the receiver. In the standard receiver, using the Type 797006-1 or 797006-3 RF Assembly, the stability of the reference is .7 ppm. Where greater stability is required, the optional Type 797006-2 and 797006-4 assemblies provide .1 PPM. stability. Additionally, the reference generator may be locked to an external reference by connecting an external 1, 2, 5, or 10 MHz reference signal, at a level of 200 mV P/P, at the rear panel EXTERNAL REFERENCE connector (A3J3). When an external input at one of the specified frequencies is present at this input, its presence is automatically sensed, and the reference generator locks to the external signal. The 10 MHz reference is then provided as the time base for the 1st, 2nd, and 3rd local oscillators.

The 1st LO circuit is a translation oscillator, comprised of the 1st LO VCO, a coarse tuning phase-locked-loop synthesizer, and a fine tuning phase-locked-loop synthesizer. The combined circuitry produces the variable 1st LO output, used to provide signal tuning. The output ranges from 40.455 MHz to 70.455 MHz for tuned frequencies ranging from 0.0000 to 30.0000 MHz, respectively. This output is provided to the first mixer (U28) to produce a 40.455 MHz 1st IF.

The 2nd LO circuit produces a fixed 40 MHz output. It is produced by multiplying the 10 MHz reference signal by a factor of four. The 40 MHz output is then provided to the 2nd mixing stage (U30) to produce 455 kHz 2nd IF. The 40 MHz 2nd LO is also provided to the Digital Assembly for use as the time-base for the control microprocessor and analog to digital conversion circuitry. This signal is output via pin 23 of connector A3E1 (LO2).

The 3rd LO circuit uses a phase-locked-loop synthesizer, locked to the 10 MHz reference, to produce the fixed 430 kHz 3rd LO signal. This 430 kHz signal is provided to the 3rd mixing stage (U31) to produce the 25 kHz 3rd IF. The 430 kHz 3rd LO signal is also directed via pin 17 of A3E1 to the Digital Assembly. It is used in the Digital Assembly for analog reconstruction of the IF signal for output to the rear panel IF OUTPUT (A2J1).

The RF/IF signal path accepts the 0.5000 to 30.0000 MHz input spectrum, provides input filtering, and using multiple conversion stages, produces the 455 kHz and 25 kHz IF outputs. The signal enters the assembly via the 50 ohm RF INPUT (A3J1). The signal passes through an lowpass input roofing filter, having a nominal 32 MHz cutoff frequency. This permits the 0.5000 to 30.0000 MHz HF spectrum to pass while attenuating signals above the receiver tuning range. The input filtering provides improved IF and image frequency rejection. Beyond the 32 MHz cutoff frequency, the filter response drops sharply, providing approximately 80 dB of ultimate attenuation. The the filtered RF input is then directed through a selectable front end gain/attenuation control circuit, providing three operator selectable front end settings. It permits the operator to route the signal directly to the 1st conversion stage, or, depending on signal conditions, introduce front end gain or attenuation. In the NORMAL mode, the signal is

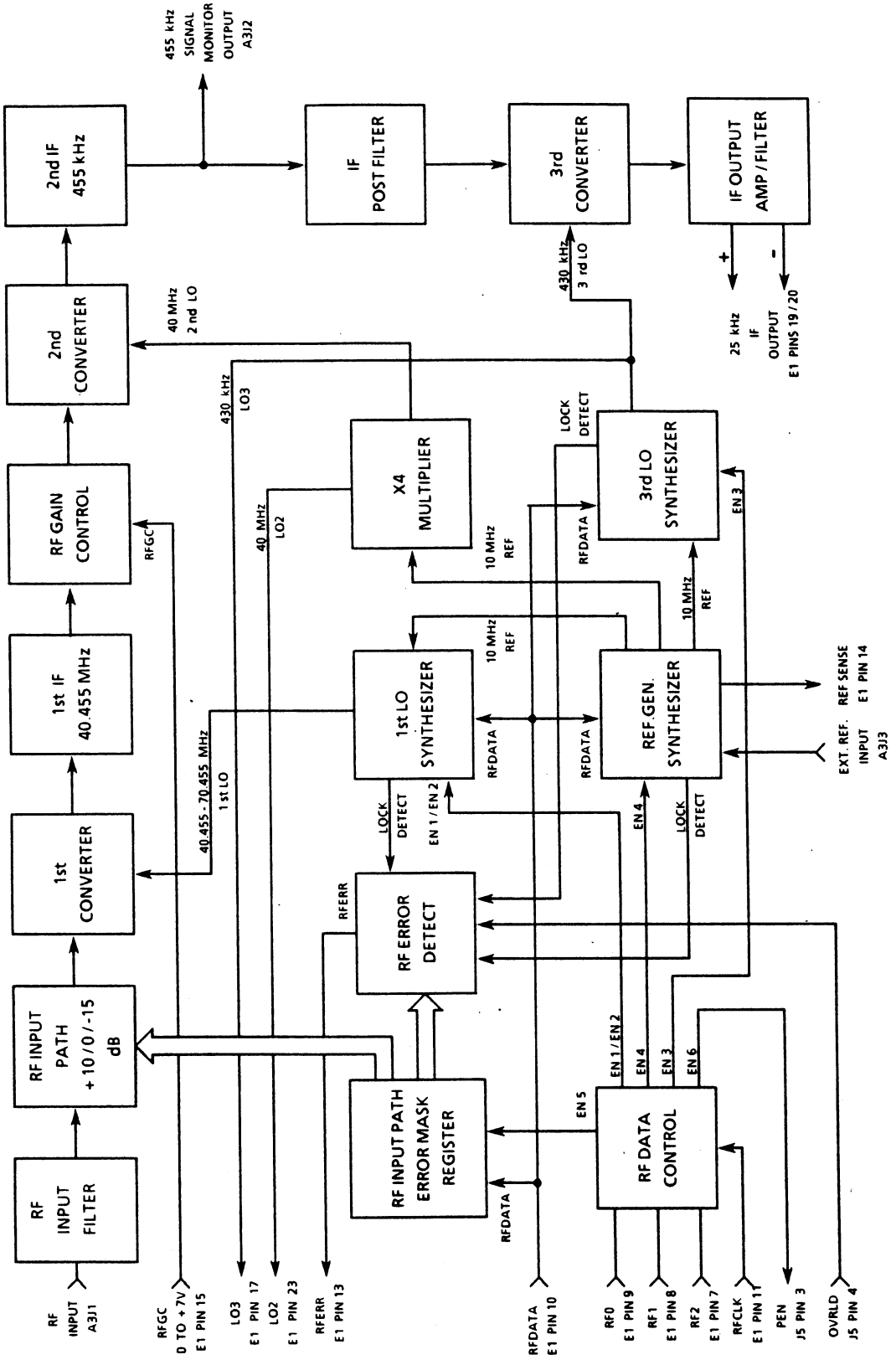



**Figure 6-2. Type 797006 RF Assembly Block Diagram**

passed directly through this circuit with no effect on signal amplitude. Under weak signal conditions, the +10 dB gain path provides 10 dB of signal amplification. The third signal path is for extremely strong signal conditions. The -15 dB selection passes the signal through a 15 dB resistive pad to reduce the signal entering the receiver front end. This attenuation pad is capable of dissipating up to 1 watt to provide protection at the receiver input.

The 1st stage of conversion consists of a high intercept mixer that mixes the RF spectrum with the 1st LO signal, ranging from 40.455 MHz (0.0000 MHz Tuned Frequency) to 70.455 MHz (30.0000 MHz Tuned Frequency). The mixer output is bandpass filtered to select the 40.455 MHz difference frequency. The 1st IF filter provides a 30 kHz bandpass, centered at 40.455 kHz.

After IF filtering and amplification, the 40.455 kHz IF signal is directed to the second conversion stage, via a voltage controlled attenuator. This circuit provides control over the amplitude of the signal to the proper output level, preventing overloading of the analog to digital converter stage in the Digital Assembly. The RF GAIN input at pin 15 of connector E1 is provided by the control processor in the Digital Assembly (A2). It is the result of the DSP microprocessor sampling the value of the signal level after digitization. This voltage ranges from 0 to +7 V, providing approximately 60 dB of gain control. This voltage is strictly dependent on the signal level and is independent of the receiver's AGC or manual gain setting.

The 2nd conversion stage mixes the signal with the fixed 40 MHz 2nd LO signal, producing the 455 kHz 2nd IF. After filtering to remove the undesired mixing products, the IF signal is split into two paths. The first path directs the 455 kHz IF out to the rear panel SIGNAL MONITOR OUTPUT (A3J2). This provides a 50 ohm output at a level of approximately 30 dB greater than the RF INPUT at connector A3J1. The Signal Monitor Output bandwidth is approximately 30 kHz wide.

The second signal path for the 2nd IF signal is through the third stage of conversion. The signal is mixed with the 430 kHz 3rd LO signal, producing the 25 kHz 3rd IF signal. After filtering, the 25 kHz IF is output, via pins 19 and 20 of connector E1, to the Digital Assembly for digitization and further processing. It is a differential output, having a level approximately 53 dB greater than the RF input. The bandwidth is approximately 25 kHz.

All control over the operation of the Type 797006 RF Assembly is performed by the Digital Assembly via pins 7 through 15 of connector A3E1. Connector E1 pin 15 provides a 0 to +7 V level, controlling the gain of the RF signal path. It is the result of sampling of the IF signal level after digitization. The remaining pins are used for monitoring the RF Assembly operation and sending control data for tuning and setting RF front end Gain/Attenuation selection.

The PRE/OPT (pin 12), RF ERR (pin 13), and REF SENSE (pin 14) are all outputs from the RF assembly to the Digital Assembly. They provide the control microprocessor with the operating status. The PRE/OPT line (pin 12) indicates when the WJ-8712/PRE optional Preselector is installed in the receiver. When the optional preselector assembly is present, it sets this line to logic "1", indicating to the control microprocessor that it must send preselector control data whenever the receiver is tuned. If the option is not installed, PRE/OPT line is held at logic "0".

The REF SENSE line (pin 14) provides an indication when an external reference is connected at the rear panel EXTERNAL REFERENCE connector (A3J3). When an external reference is connected, it causes this line to assume a logic "0" condition. The control microprocessor then tunes the reference phase-locked-loop synthesizer to each of the allowable reference input frequencies, until the reference synthesizer locks on external input. If no external reference is present, the REF SENSE line remains at logic "1" and the internal reference provides the receiver time-base.

The RF ERR line (pin 13) provides the control microprocessor with an indication of the operating status of the phase-locked-loop synthesizers in the RF assembly. When the optional preselector in installed in the receiver, this line also monitors the overload protection circuitry in the preselector and activates this line during signal overload conditions. The synthesizer lock lines of the Reference, 1st LO and 3rd LO synthesizers are ORed together, along with the preselector overload line. Any synthesizer unlock or signal overload condition causes this line to assume a logic "0" condition. Once flagged by the RF ERR line, the microprocessor individually masks each of the RF ERR controlling inputs to determine the error source and reports the appropriate error condition.

Control of the RF assembly is provided via the RF0, RF1, RF2, RF DATA, and RF CLK lines (pins 7 through 11). The RF DATA line (pin 10) carries serial data from the control microprocessor to the various controlled circuits in the RF and optional Preselector Assemblies. The data is sent as a series 8-bit data words synchronized with the data clock present on the RF CLK line (pin 11). The RF DATA line is shared by six controlled circuits each of which acts on the data only when instructed by the microprocessor via the RF0, RF1, and RF 2 control lines. These lines determine the destination of the data. **Table 6-1** lists the states of the data control lines and the associated data.

**Table 6-1. RF Data Control**

| RF2 | RF1 | RF0 | STROBE | DATA TYPE |
|---|---|---|---|---|
| 0 | 0 | 0 | EN1 | 1st LO Fine Loop Tuning Data. |
| 0 | 0 | 1 | EN2 | 1st LO Coarse Loop Tuning Data. |
| 0 | 1 | 0 | EN3 | 3rd LO Tuning Data. |
| 0 | 1 | 1 | EN4 | Reference Oscillator Tuning Data. |
| 1 | 0 | 0 | EN5 | BITE/NORM/PREAMP/ATTEN Data. |
| 1 | 0 | 1 | EN6 | Optional Preselector Band Select Data. |

### 6.2.2 TYPE 797012 DIGITAL ASSEMBLY, (A2)

This assembly is manufactured in two versions. The Type 797012-1 is the standard assembly. The Type 797012-2 version is conformal coated and is installed in receivers containing the WJ-8712/ENV option. Except for the environmental protection of the conformal coating, these two assembly versions are identical.

The Type 797012 Digital Assembly (A2) consists of three major operating sections: the Control and Interface section; the Digital Signal Processing section; and the Reconstructed Analog Section. These sections perform the IF digitization, Digital Signal Processing, Analog Reconstruction, and Receiver Control functions associated with the operation of the WJ-8712 Digital HF Receiver. The assembly also provides an interface with an external computer, or other external controlling devices, and performs the control and monitoring functions that direct the receiver operation. Refer to the Type 797012 Digital Assembly Block Diagram in **Figure 6-3** as a reference for the following assembly description. For a more detailed illustration of the Digital Assembly circuitry, refer to the Type 797012 Digital Assembly Schematic Diagram, **Figure 9-1.**

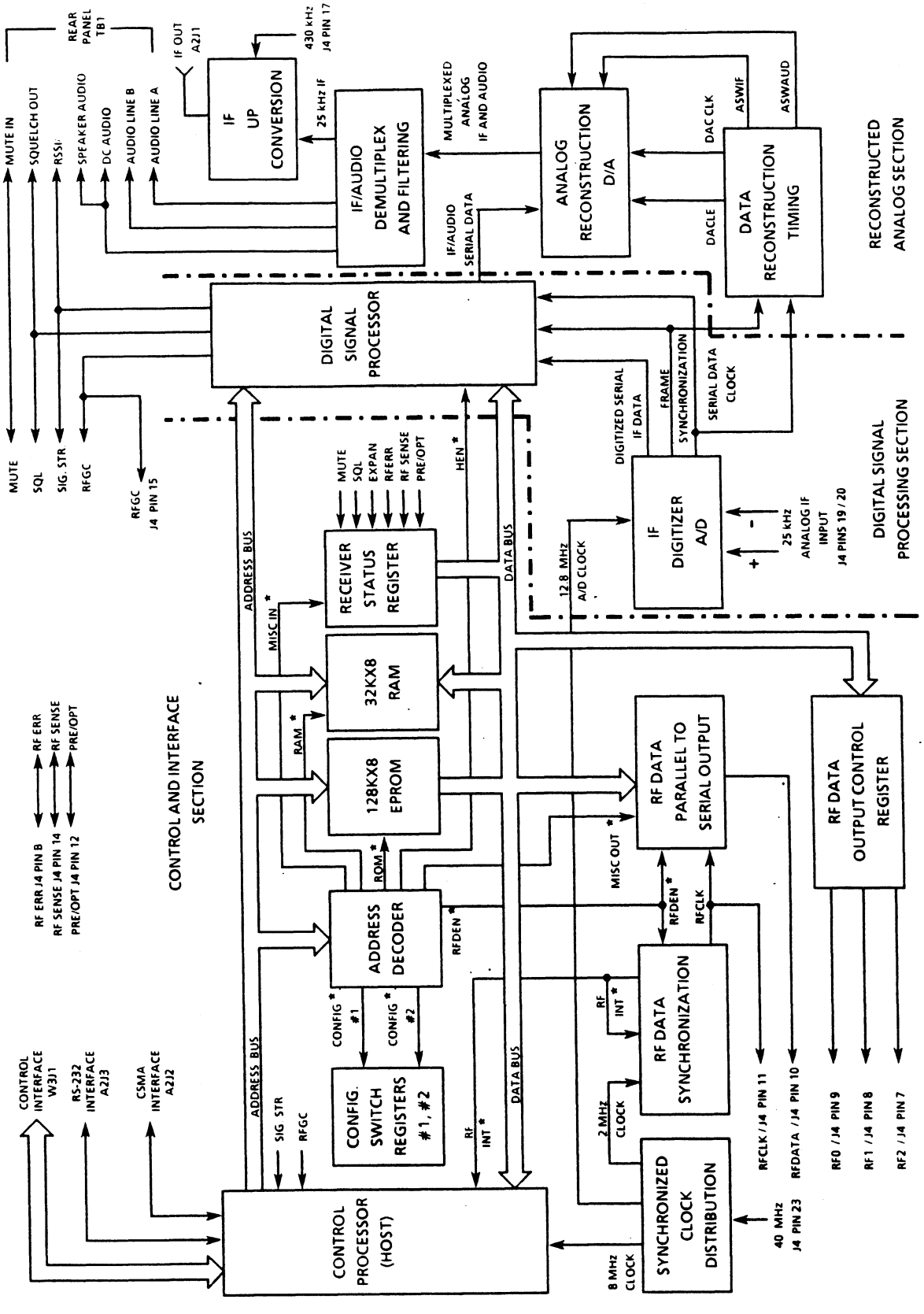



**Figure 6-3. Type 797012 Digital Assembly Functional Block Diagram**

Under the direction of the Control and Interface section, the Digital Signal Processing section takes the analog IF signal supplied by the RF Assembly, digitizes it, and processes the digitized signal data to extract the signal intelligence. Other than the signal tuning performed by the RF Assembly, the Digital Signal Processing section performs all of the receiver functions that ultimately produce the final outputs. The 25 kHz IF input enters the Digital Assembly at pins 19 and 20 of J4. This differential input has a 25 kHz bandwidth, and ranges in level from approximately .1 to .7 V peak-to-peak at each of the input pins. The signal is directed into the IF Digitizer where the analog signal is converted into digital data that can be read by the Digital Signal Processor. A 12.8 MHz clock, provided by synchronized clock distribution circuitry in the Control and Interface section provides the timing for the analog-to-digital conversion. It causes the signal to be sampled at a 100 kHz rate, producing a series of data frames, each representing one sample of the analog input. Each frame is made up of 32 data bits, 16 of which contain the digitized IF sample. The samples are provided to the DSP circuitry where the continuous time domain signal samples are converted into discrete time samples for continuous processing. Using this data, the Digital Signal Processor, digitally performs fine tuning to a 1 Hz resolution, IF bandwidth filtering, signal strength calculations, signal demodulation, noise blanking, and receiver gain control.

The outputs from the Digital Signal Processing section consists of serial data containing a digital representation of the receiver's IF (limited to the selected IF bandwidth), and detected audio, multiplexed into a single data stream. This data is routed to the Reconstructed Analog section where the signals are separated, converted back to analog signals, and output to the rear panel of the receiver. It also provides analog and digital outputs to the Control and Interface section, and to the rear panel terminal bus (TB1) for monitoring. The Squelch output line at the rear panel provides a logic level that indicates to external equipment if a tuned signal exceeds the programmed Squelch level. It is set to logic "0", whenever a tuned signal exceeds the programmed level. The signal strength output is provided at the rear panel terminal bus as the RSSI output line. It is an analog voltage ranging from 0 to +5V, representing the strength of the received signal. These outputs are also provided to the Control and Interface section for monitoring. Additionally the Digital Signal Processing section provides an RF gain control output to the Type 797006 RF assembly (A3). This output is a result of the DSP sampling the signal level at the input to the IF Digitizer. It controls the gain of the RF section to prevent the signal from over driving the input of the IF Digitizer. The voltage ranges from approximately +7.0 V with no signal present to 0 V with strong signals present.

The Reconstructed Analog section receives the Digitized IF and audio data from the Digital Signal Processing section and converts the signals back to analog form for output. In addition to the serial data, the Digital Signal Processing section provides frame synchronization and serial data clock signals for timing of the data transfer. These timing signals permit the Reconstructed Analog section to demultiplex the signals into separate IF and audio signals. The reconstructed IF signal, converted back to a 25 kHz analog IF, is mixed with a 430 kHz local oscillator signal from the RF Assembly (A3), provided via pin 17 of J4. This mixing process up-converts the IF signal to 455 kHz. The signal is then provided to rear panel connector A2J1. This 50 output provides a 455 kHz IF output, limited in bandwidth to the selected IF bandwidth. The level is approximately -20 dBm when loaded into 50 ohms.

The reconstructed audio is filtered and routed to the rear panel terminal bus as the Line A and Line B audio outputs. These are 600 ohm balanced outputs for use with external audio monitoring devices. A DC Audio output is also provided at the rear panel terminal bus. It is an unbalanced, DC coupled audio output. The final audio output is provided to the front panel PHONES jack, via the Type 383076 Power Distribution Assembly (A1).

The Control Interface Section directs the operation of the Type 797006 RF Assembly (A3) and it directs the operation of the functions performed by the Digital Signal Processing Section, contained on this assembly.

The heart of the Control Interface Section is the 68HC11 microcontroller. It continuously monitors the receiver functions and provides control data to direct its operation. On receiver power up, the control processor enters into a power up routine that checks the two banks of configuration switches to properly configure the external control interfaces for communication with external controlling devices, and it performs a built-in-test (BITE) operation to verify proper operation of key receiver parameters. Once the configuration and testing have been completed, the microcontroller then directs control data to the RF Assembly and the Digital Signal Processing section to set the receiver parameters for operation. The communication with the Digital Signal Processing section is via the microcontroller's address and data buses. It consists of data that determines the parameters that the Digital Signal Processor uses in processing of the tuned signal.

The transfer of control data to the RF section is performed through a ribbon cable connected at J4. This data (RF DATA) is transferred serially as a sequence of 8-bit data words, via J4 pin 10, and provides the data to five control registers in the RF Assembly that: phase locks the receiver time base; tunes the RF Assembly to the desired frequency; and selects the NORMAL, PREAMPLIFIED, or ATTENUATED RF Input Path. Three control lines (RF0, RF1, and RF2) are set as each each data word is transferred, determining the destination of the data after it reaches the RF Assembly. These control lines form a three bit address via pins 9, 8, and 7 of J4, respectively, which are decoded by the RF Assembly to properly direct the data transfer (refer to **Table 6-1**). The RF DATA, and the RF0, RF1, and RF2 Control lines are synchronized with the RF clock (RFCLK), J4 pin 11. This is a sequence of 8 bit clock bursts that provide timing for the data transfer.

Three status lines, provided via connector J4, are monitored by the Control Section to determine the operating status of the RF assembly. They are routed to a receiver status input register, and are checked periodically to verify proper operation and to determine if any control action is to be taken. The RFERR status line provides a logic level to notify the Control section if an error condition occurs. With an external reference connected to the receiver rear panel, and, with all of the phase-locked-loop synthesizers in the RF Assembly locked and operating normally, the RFERR line provides a constant logic "1". If any of the synthesizers fail, the unlocked synthesizer causes a logic "0". If no external reference is connected to the receiver rear panel, the internal reference is active, and logic "0" pulses occur at intervals of approximately 8 msec. Also, if the receiver is equipped with the RF Preselector option, a signal overload will result in a logic "0" on the RFERR line.

The Control and Interface section timing is synchronized with the receiver's time base by a 40 MHz signal, provided by the RF Assembly via J4 pin 23. This signal enters the synchronized clock distribution circuitry of the Control and Interface section, where it is used to generate an 8 MHz clock for the microcontroller, a 2 MHz clock to provide timing for transferring control data to the RF Assembly, and the 12.8 MHz clock for timing of the analog-to-digital conversion in the IF digitizer.

Three methods of control of the receiver operation are supported by the Control and Interface section. The RS-232 interface provides a communications link from the microcontroller to a 25 pin RS-232 connector at the receiver rear panel (A2J3). This is a three wire configuration that permits talk and listen capabilities, using RS-232 levels. The CSMA interface provides limited receiver control capabilities. The Carrier Sense Multiple Access is a two wire bidirectional interface that provides limited control using TTL logic levels. This

interface provides a communication link via a mini phone jack at the rear panel (A2J2). The third form of receiver control is via the Control Interface output (A2J7). This interface is routed to a 25 pin connector on the receiver front panel. It is designed to interface with the TF-30387 Front Panel Interface. With this optional control device installed, a local operator or test personnel can take control of the receiver. A full set of controls and indicators provide the same control capability as is available at the RS-232 interface.

### 6.2.3 TYPE 383076 POWER DISTRIBUTION, (A1)

The Type 383076 Power Distribution Assembly (A1) is a power and phone audio interface. This assembly is manufactured in two versions. The Type 383076-1 is the standard assembly. The Type 383076-2 version is conformal coated, and is installed in receivers containing the WJ-8712/ENV option. Refer to the Type WJ-8712 Digital HF Receiver Main Chassis schematic diagram, **Figure 9-3**, for an illustration of this assembly.

This assembly accepts the +12V, -12V, +5V, and the PWR FAIL outputs from the power supply at connector J1 and directs these signals out through E1 to the Digital Assembly for further distribution. On this assembly, the +12V input is split to provide the operating voltage for the Fan Assembly (B1). The voltage to the fan is output through connector J3. The fan output is filtered to prevent electrical noise from being fed back into the +12V line.

The Type 383076 Power Distribution Assembly also provides an interface between the Type 797012 Digital Assembly and the receiver front panel for the Phone Audio and the Phone Audio level control. The Digital Assembly provides +12V and -12V to the level control via pins 19 and 21 of connector A1J8. They are routed to the level control through pins 1 and 6 of connector J6. The wiper of the level control then provides a the proper bias current back to the audio circuitry to set the Phone Audio volume, based on the positioning of the control.

The audio provided to the front panel Phones jack consist of Left and Right audio, entering from the Digital Assembly via pins 22 and 24 of J8. After low pass filtering to filter out RF and digital noise, the audio signals are directed to the Phones jack via pins 1 and 2 of connector J4.

### 6.2.4 TYPE 841784/841792 POWER SUPPLY ASSEMBLY, (PS1)

The Type 841792 or Type 841792. Power Supply, illustrated in the WJ-8712 Digital HF Receiver Main Chassis schematic diagram, **Figure 9-3**, Provides the voltages required for the proper operation of the WJ-8712 Receiver. It also provides a PWR FAIL logic level to flag the control microcontroller when the output voltages are not sufficient to permit stable operation.

The Type 841792 Power Supply is capable of providing reliable outputs over a wide range if input line voltages and frequencies. It operates from 97 to 253 VAC, at line frequencies ranging from 47 to 440 Hz. The voltage outputs under load are as follows:

| Voltage | Current (Max.) | Tolerance | Ripple (Max.) |
|---|---|---|---|
| +5 V | 3.0 A | ±2% | 50 mv P-P |
| +12 V | 1.5 A | ±4% | 50 mv P-P |
| -12 V | 0.5 A | ±4% | 50 mv P-P |

The PWR FAIL output provides a logic output when the DC output voltages are out of tolerance. This output is a logic"1" (greater than 4.0V) during normal operation. In a power fail state, the line goes to logic "0" (less than 0.4 V).

# SECTION VII

# MAINTENANCE

# SECTION VII

# MAINTENANCE

## 7.1 GENERAL

The WJ-8712 Digital HF Receiver has been designed to operate for extended periods of time with a minimum of routine maintenance. Cleaning, inspection and performance tests should be performed at regular intervals, consistent with the facility's normal scheduling and after repairs have been made.

## 7.2 CLEANING AND LUBRICATION

The receiver should be kept free of dust, moisture, grease and other foreign matter to ensure trouble-free operation. Use low pressure air, if available, to remove accumulated dust from the interior of the receiver. A clean, dry cloth or soft bristled brush may also be used for this purpose. No lubrication is required.

## 7.3 INSPECTION FOR DAMAGE AND WEAR

Many existing or potential troubles can be detected by making a thorough visual inspection of the unit. For this reason, as a first step in troubleshooting, a complete visual inspection should be made whenever the unit is inoperative. Inspect mechanical parts such as pin connectors and interconnecting cables for looseness, wear and other signs of deterioration. The subassemblies should be checked to assure that they are properly secured to the chassis and making good electrical contact. Electronic components that show signs of deterioration, such as overheating, should be inspected and a thorough investigation of the associated circuitry should be made to verify proper operation. Often, damage due to heat is a result of other, less apparent problems in the circuit.

## 7.4 TEST EQUIPMENT REQUIRED

Procedures for testing the WJ-8712 Receiver have been developed for performance using a minimum of common test equipment. The test equipment listed in **Table 7-1**, or equivalents, are required to perform the troubleshooting procedures and performance tests described in this section.

## 7.5 TROUBLESHOOTING AND FAULT ISOLATION

The test procedures that are provided in this section verify proper receiver operation and assist in fault isolation to a malfunctioning subassembly. They have been developed to set known laboratory conditions that eliminate external conditions as a possible cause of the malfunction. Use performance tests in **paragraph 7.6**, and the circuit descriptions in **Section VI** to assist in fault isolation.

## 7.6 WJ-8712 DIGITAL HF RECEIVER PERFORMANCE TESTS

The performance tests that follow are designed to verify proper operation of the WJ-8712 Receiver, and each of its operational modules. In performance of the tests, the receiver may be controlled by an external controlling computer, connected to the Rear Panel RS-232 connector, or the TF-30387 Test Fixture, connected to the front panel Control Interface connector. Each procedure provides sufficient set up information to accommodate either control device.

**Table 7-1. Required Test Equipment**

| Equipment | Recommended Type | Requirement |
|---|---|---|
| Variable Frequency Power Source | Elgar 501A | Voltage Range - 97 to 253 VAC<br>Frequency Range - 47 to 440 Hz |
| Volt-Amp-Power Meter | Clark-Hess 255 | Power Measurement |
| Signal Generator (Qty 2) | HP-8640B | Frequency Range to 30 MHz<br>Internal Modulation Capability |
| Frequency Counter | Fluke 1953A | Frequency Range to 100 MHz |
| RF Millivoltmeter<br>RF Probe<br>"T" Adapter<br>50 Ohm Termination | Boonton 92B<br>Boonton 91-12F<br>Boonton 91-14A<br>Boonton 91-15A | dB Scale Referenced to 50 Ohm Load |
| AC Voltmeter | HP-400EL | dB Scale Referenced to 600 Ohm Load |
| Distortion Analyzer | HP-334A | Harmonic Distortion Measurement |
| Digital Voltmeter | Fluke 8001A | AC/DC Voltage Measurement |
| Oscilloscope | Tektronix 2236 | 100 MHz Frequency Response |
| Control Test Fixture | TF-30387 (Watkins-Johnson) | WJ-8712 Front Panel Control (Optional) |
| Assembly Test Cable | TC-XXXX (Watkins-Johnson) | Assembly Interface Testing |
| Control Computer | IBM PC Compatible | RS-232 Compatible |

### 7.6.1 POWER CONSUMPTION

1. Connect the WJ-8712 Receiver and test equipment as illustrated in **Figure 7-1.**
2. Set the Clark-Hess Volt-Amp-Wattmeter function to the power mode, with the 500 ma current range selected. Set the voltage range as required for the line voltage being tested.
3. Adjust the variable Frequency Power Source to the line frequency and voltage at which the receiver is to be operated.

**NOTE**

Power requirements for the WJ-8712 Receiver may range from 97 to 253 VAC, with a line frequency ranging from 47 to 440 Hz.

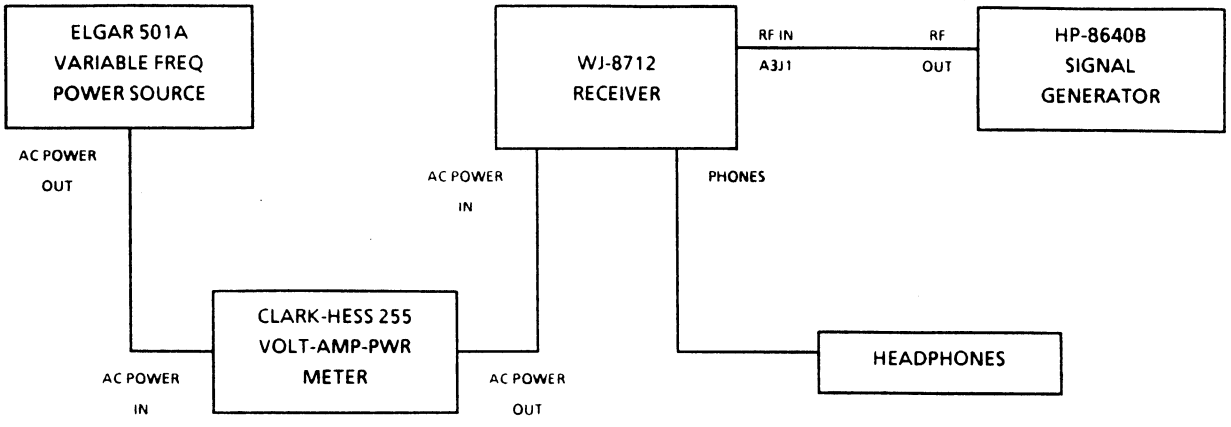



**Figure 7-1. Power Consumption Performance Test Equipment Connection**

4. Set the Signal Generator to produce a 1.0000 MHz output at a level of -90 dBm. Set the generator modulation for 400 Hz AM, 50% modulation.

5. Apply power to the receiver and set the receiver parameters as follows:

| | | |
|---|---|---|
| Tuned Frequency: | 1.000000 MHz | FRQ 1 <Return> |
| Detection Mode: | AM | DET 1 <Return> |
| IF Bandwidth: | 6.0 kHz | BWS 4 <Return> |
| Gain Control: | AGC Fast | AGC 2 <Return> |
| Squelch: | Off | SQL 136 <Return> |

6. Adjust the PHONES LEVEL control for a clear 400 Hz audio tone in the headphones.

7. Verify that the power consumption level displayed on the Volt-Amp-Wattmeter does not exceed 40 Watts.

8. Slowly increase and decrease the Variable Frequency Power Source by 10% of the initially set value while observing the power consumption level on the Volt-Amp-Wattmeter. Verify that the power consumption throughout the ±10% range at 40 Watts or less and a clear audio tone remains present in the headphones.

6. Set Signal Generator #2 to produce a 10.0000 MHz CW signal at an output level of 0 dBm. Connect the Signal Generator output to the EXT. REF. connector at the receiver rear panel (A3J3).

7. Note the frequency displayed on the frequency counter. This frequency should be approximately 1000 Hz, depending on the accuracy of the frequency setting in step 2.

8. While observing the frequency counter display, slowly increase and decrease the frequency of generator #2. Verify that the frequency displayed on the frequency counter changes with changes in the generator frequency, indicating that the receiver timebase is locked to the eternal reference.

**NOTE**

The magnitude of change on the frequency counter does not match the generator changes due to frequency scaling within the receiver.

### 7.6.3 FINE TUNING ACCURACY

1. Connect the WJ-8712 Receiver and test equipment as illustrated in **Figure 7-3.**

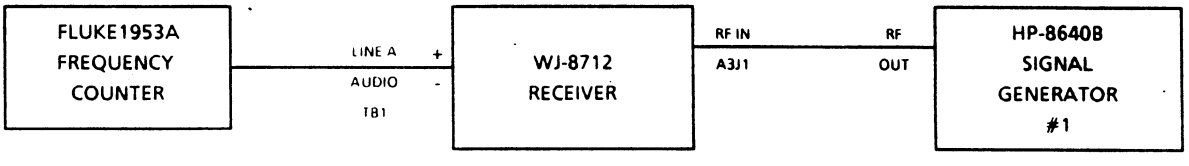



**Figure 7-3. Fine Tuning Accuracy Performance Test Equipment Connection**

2. Set the signal generator to produce a 10.000000 MHz CW signal at an output level of -40 dBm.

3. Set the WJ-8712 Receiver as follows:

| | | |
|---|---|---|
| Tuned Frequency: | 10.000000 MHz | FRQ 10 <Return> |
| Detection Mode: | CW | DET 3 <Return> |
| BFO Offset: | +1.00 kHz | BFO 1000 <Return> |
| IF Bandwidth: | 16.0 kHz | BWS 5 <Return> |
| Gain Control: | AGC Slow | AGC 1 <Return> |
| Squelch: | Off | SQL 136 <Return> |

4. Set the frequency counter for 1.0 Hz resolution.

5. Note the frequency displayed on the frequency counter as a reference for the tuning accuracy tests. The displayed frequency is the difference between the receiver and the signal generator frequencies, plus the 1000 Hz BFO offset.

6. While observing the frequency counter display, slowly increase the receiver tuned frequency in 1 Hz, 10 Hz, 100 Hz, and 1 kHz steps. Verify that the magnitude of change on the frequency counter display tracks with the receiver tuned frequency changes, maintaining a frequency that is 1 kHz greater than the difference between the signal generator and receiver frequencies.

**NOTE**

Maintain tuned frequencies between 10.000000 and 10.008000 MHz to avoid exceeding the 16.0 kHz IF bandwidth limitations.

### 7.6.4 SIGNAL STRENGTH ACCURACY

1. Connect the HP-8640B Signal Generator to the RF Input of the WJ-8712 Receiver (A3J1).

2. Set the signal generator to produce a 15.0000 MHz CW signal at an output level of -100 dBm.

3. Connect the digital voltmeter between the RSSI pin and ground on the rear panel terminal bus (TB1). Set the digital voltmeter function to DC Voltage, 10 V range.

4. Set the WJ-8712 Receiver as follows:

| | | |
|---|---|---|
| Tuned Frequency: | 15.000000 MHz | FRQ 15 <Return> |
| Detection Mode: | CW | DET 3 <Return> |
| BFO Offset: | +0.00 kHz | BFO 0 <Return> |
| IF Bandwidth: | 6.0 kHz | BWS 4 <Return> |
| Gain Control: | AGC Slow | AGC 1 <Return> |
| Squelch: | Off | SQL 136 <Return> |

5. Slowly increase the signal generator output level to 0 dBm, in 10 dB increments. At each increment, note the DC voltage displayed on the digital voltmeter and verify the receiver signal level using the "SGV?" query. If the TF-30387 Control Test Fixture is used, observe the signal level on the signal strength meter.

6. Verify that the receiver signal strength indication remains within ±10 dB of the signal generator output level. The DC voltage present at the RSSI output should range from approximately +1.0 V (-100 dBm) to +4.6 V (0 dBm). For each 10 dB increase of input level, the RSSI level should increase by approximately +.35 V.

### 7.6.5 WJ-8712 SENSITIVITY PERFORMANCE TEST

1. Connect the WJ-8712 Receiver and test equipment as illustrated in **Figure 7-4.**

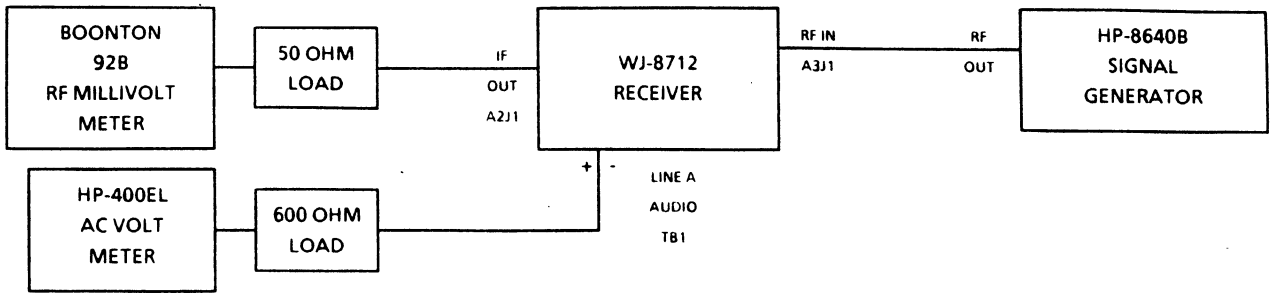



**Figure 7-4. Receiver Sensitivity Performance Test Equipment Connection**

2. Set the WJ-8712 Receiver as follows:

| | | |
|---|---|---|
| Tuned Frequency: | 0.500000 MHz | FRQ 5 <Return> |
| Detection Mode: | CW | DET 3 <Return> |
| BFO Offset: | +1000 Hz | BFO 1000 <Return> |
| IF Bandwidth: | See Table 7-3 | |
| Gain Control: | Manual | AGC 0 <Return> |
| Gain Setting: | Mid-Range 060 | RFG 60 <Return> |
| RF Input Path | Preamplified | RFP 3 <Return> |
| Squelch: | Off | SQL 136 <Return> |

3. Set the receiver tuned frequency to 0.500000 MHz [FRQ .5 <Return>] and set the signal generator to produce a .5000 MHz CW output at a level of -116 dBm.

4. Set the receiver IF bandwidth and the corresponding signal generator output level to each of the settings listed in **Table 7-2.** For each of the listed settings, perform the test described in steps 5 through 8.

**Table 7-2. Sensitivity Performance Test Parameters**

| IF BW (kHz) | COMMAND | SIG. GEN OUPUT LEVEL (dBm) | AM MODULATION | FM MOD. FRQ / DEV. |
|---|---|---|---|---|
| 0.30 | BWS 1 <Return> | -116 | 100 Hz / 50% | 100 Hz / 90 Hz |
| 1.00 | BWS 2 <Return> | -111 | 400 Hz / 50% | 400 Hz / 300 Hz |
| 3.20 | BWS 3 <Return> | -106 | 400 Hz / 50% | 400 Hz / 960 Hz |
| 6.00 | BWS 4 <Return> | -103 | 400 Hz / 50% | 400 Hz / 1800 Hz |
| 16.0 | BWS 5 <Return> | -99 | 400 Hz / 50% | 400 Hz / 4800 Hz |

5. Set the receiver RF Gaine as required to produce a -20 dBm indication on the RF millivoltmeter.

6. Note the Line A audio level indicated on the AC voltmeter as the reference level for the following CW sensitivity performance test. The typical AC voltmeter indication is 0 ±3 dBm.

7. While observing the AC voltmeter indication, turn off the signal generator RF Output.

8. Note the AC voltmeter level with the RF signal removed. Calculate the signal-to-noise ratio by subtracting this level from the reference level noted in step 6. The difference between these two levels should be a minimum of 16 dB.

9. Tune the receiver and signal generator to 5.0000 MHz, 15.0000 MHz, and 29.9000 MHz. At each frequency, repeat the test described in steps 4 through 8.

10. Set the receiver for a .50000 MHz tuned frequency [FRQ .5 <Return>], AGC Fast [AGC 2 <Return>], and select the AM Detection Mode [DET 1 <Return>]. Set the signal generator to produce a .5000 MHz AM modulated signal.

11. Set the receiver IF bandwidth, the corresponding signal generator RF output level, and the AM modulation as listed in **Table 7-2.** For each of the listed settings, perform the test described in steps 12 through 15.

12. Note the Line A audio level indicated on the AC voltmeter as the reference level for the following AM sensitivity performance test. The typical AC voltmeter indication is +6 ±3 dBm.

13. While observing the AC voltmeter indication, turn the signal generator AM modulation off.

14. Note the AC voltmeter level with the AM modulation removed. Calculate the signal-to-noise ratio by subtracting this level from the reference level noted in step 12. The difference between these two levels should be a minimum of 10 dB.

15. Tune the receiver and signal generator to 5.0000 MHz, 15.0000 MHz, and 29.9000 MHz. At each frequency, repeat the test described in steps 11 through 14.

16. Set the receiver for a .50000 MHz tuned frequency [FRQ .5 <Return>], AGC Fast [AGC 2 <Return>], and select the FM Detection Mode [DET 2 <Return>]. Set the signal generator to produce a .5000 MHz FM modulated signal.

17. Set the receiver IF bandwidth, the corresponding signal generator RF output level, and the FM modulation as listed in **Table 7-2.** For each of the listed settings, perform the test described in steps 18 through 21.

18. Note the Line A audio level indicated on the AC voltmeter as the reference level for the following FM sensitivity performance test. The typical AC voltmeter indication is +0 ±3 dBm.

19. While observing the AC voltmeter indication, turn the signal generator FM modulation off.

20. Note the AC voltmeter level with the FM modulation removed. Calculate the signal-to-noise ratio by subtracting this level from the reference level noted in step 18. The difference between these two levels should be a minimum of 17 dB.

21. Tune the receiver and signal generator to 5.0000 MHz, 15.0000 MHz, and 29.9000 MHz. At each frequency, repeat the test described in steps 17 through 20.

22. Set the receiver for a .50000 MHz tuned frequency [FRQ .5 <Return>], Manual Gain [AGC 0 <Return>], and select the ISB Detection Mode [DET 6 <Return>]. Set the signal generator to produce a .5010 MHz CW output signal, at a level of -113 dBm.

23. Set the receiver RF Gain as required to produce a -20 dBm indication on the RF millivoltmeter.

24. Note the Line A audio level indicated on the AC voltmeter as the reference level for the following SSB sensitivity performance test. The typical AC voltmeter indication is +0 ±3 dBm.

25. While observing the AC voltmeter indication, turn off the signal generator RF Output.

26. Note the AC voltmeter level with the RF signal removed. Calculate the signal-to-noise ratio by subtracting this level from the reference level noted in step 24. The difference between these two levels should be a minimum of 16 dB.

27. Temporarily remove the AC voltmeter and 600-ohm load from the Line A output of TB1 and connect them across the + and - terminals of the Line B output. Tine the signal generator to 1.0000 kHz below the receiver tuned frequency and repeat steps 23 through 26 to verify the lower sideband of the ISB outputs.

28. Reconnect the AC voltmeter and 600-ohm load across the Line A output terminals.

29. Tune the receiver and signal generator to 5.0000 MHz, 15.0000 MHz, and 29.9000 MHz. In each case, set the signal generator frequency for 1.0000 kHz above the receiver tuned frequency. At each frequency, repeat the test described in steps 23 through 27.

## 7.6.6 AUDIO DISTORTION PERFORMANCE TEST

1. Connect the WJ-8712 Receiver and test equipment as illustrated in **Figure 7-5.**

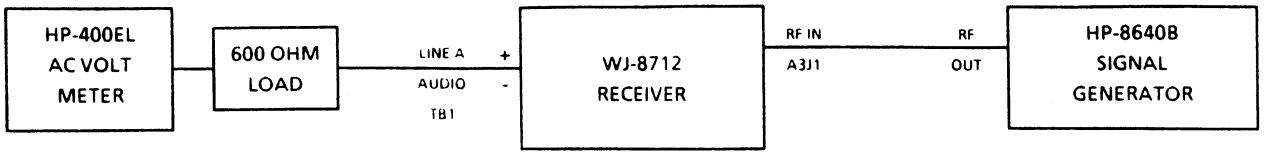



**Figure 7-5. Audio Distortion Performance Test Equipment Connection**

2. Set the signal generator to produce a 15.0000 MHz AM modulated signal at an output level of -50 dBm. Set the AM modulation to 400 Hz, at 30 %.

3. Preset the distortion analyzer as follows:

| | |
|---|---|
| Mode: | Manual |
| Frequency Range: | X10 |
| Function: | Voltmeter |
| Meter Range: | 1 Volt |

4. Set the WJ-8712 Receiver as follows:

| | | |
|---|---|---|
| Tuned Frequency: | 15.000000 MHz | FRQ 15 <Return> |
| Detection Mode: | AM | DET 1 <Return> |
| IF Bandwidth: | 6.0 kHz | BWS 4 <Return> |
| Gain Mode: | AGC Slow | AGC 1 <Return> |
| Gain Setting: | Mid-Range 060 | RFG 60 <Return> |
| RF Input Path | Normal | RFP 1 <Return> |
| Squelch: | Off | SQL 136 <Return> |

5. Verify that the detected audio level is 0 ±3 dBm, as indicated on the analyzer voltmeter.

**NOTE**

Due to a +10 dB offset on the distortion analyzer voltmeter, the +10 dB scale is used for a 0 dBm reading.

6. Reset the distortion analyzer meter range to the 3 volt scale and increase the signal generator modulation level to 50%.

7. Set the distortion analyzer function control and meter range to the SET LEVEL positions. Adjust the distortion analyzer sensitivity control for a 100% indication on the meter (an indication of "1" on the 0-1 scale).

8. Set the distortion analyzer function control to the Distortion position. Slowly adjust the distortion analyzer Frequency control for a minimum indication on the meter. Reset the meter range as required for the best meter resolution. Verify that the total harmonic distortion measured does not exceed 5%.

9. Set the receiver detection mode to ISB [DET 6 <Return>].

10. Reset the distortion analyzer as follows:

| | |
|---|---|
| Mode: | Manual |
| Frequency Range: | X100 |
| Function: | Voltmeter |
| Meter Range: | 3 Volt |

11. Reset the signal generator to produce a 15.0010 MHz CW signal at a -50 dBm output level (modulation off, frequency 1.0 kHz greater than the receiver tuned frequency).

12. Verify that the detected audio level indicated on the distortion analyzer voltmeter is 0 ±3 dBm.

13. Set the distortion analyzer function control and meter range to the SET LEVEL positions. Adjust the distortion analyzer sensitivity control for a 100% indication on the meter.

14. Set the distortion analyzer function control to the Distortion position. Slowly adjust the distortion analyzer Frequency control for a minimum indication on the meter. Reset the meter range as required for the best meter resolution. Verify that the total harmonic distortion measured does not exceed 5%.

## 7.6.7 SQUELCH/MUTE PERFORMANCE TEST

1. Connect the WJ-8712 Receiver and test equipment as illustrated in **Figure 7-6.**

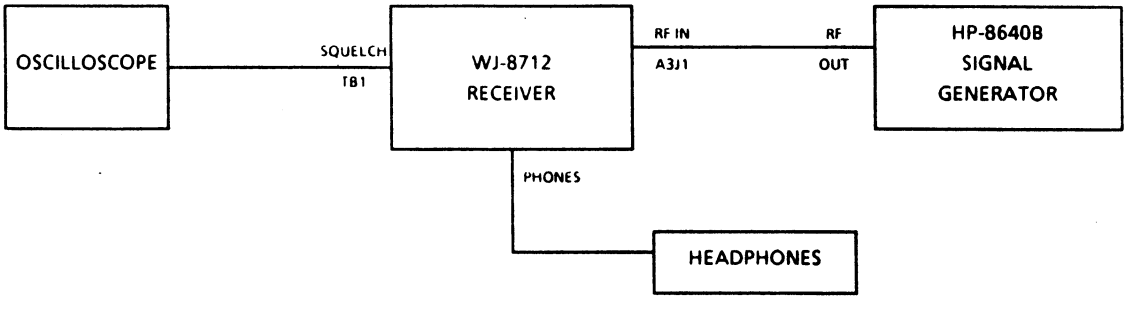



**Figure 7-6. Squelch/Mute Performance Test Equipment Connection**

2. Set the WJ-8712 Receiver as follows:

| | | |
|---|---|---|
| Tuned Frequency: | 15.000000 MHz | FRQ 15 <Return> |
| Detection Mode: | AM | DET 1 <Return> |
| IF Bandwidth: | 6.0 kHz | BWS 4 <Return> |
| Gain Mode: | AGC Fast | AGC 2 <Return> |
| RF Input Path | Normal | RFP 1 <Return> |
| Squelch: | -120 | SQL 120 <Return> |

3. Set the signal generator to produce a 15.0000 MHz CW output at a level of -130 dBm.

4. Observe that a steady logic "1" level (+5V) is present at the Squelch terminal of the rear panel terminal bus (TB1), as indicated on the oscilloscope.

5. While observing the oscilloscope trace, slowly increase the signal generator output level until the trace indicates a logic "0" (0V) level. Note the signal generator output level at which the squelch output switches. Verify that the signal generator output level is within ±10 dB of the receiver squelch setting.

6. Increase the receiver squelch threshold in 10 dB increments, up to 0 dBm. At each increment, increase the signal generator output level until the oscilloscope displays a logic "0" level, indicating that the squelch has turned off. Note the signal generator output level at each switchpoint. Verify that at each level tested, the signal generator output level is within ±10 dB of the receiver squelch setting.

7. Set the squelch to -100 dBm [SQL 100 <Return>] and set the signal generator to produce a 15.0000 MHz AM modulated output, at a level of -40 dBm. Set the modulation to 400 Hz, 50%.

8. Observe that a clear 400 Hz tone is present in the headphones, and the oscilloscope indicates a logic "0" at the squelch output terminal.

9. While monitoring the headphone audio and the oscilloscope display, connect a short jumper between the MUTE terminal of TB1 and ground. Observe that the audio cuts off and after a slight delay, the squelch line switches to Logic "1".

10. Remove the jumper and verify that the audio, and the squelch logic level return to the state observed in step 8.

## 7.6.8 RECONSTRUCTED IF OUTPUT PERFORMANCE TEST

1. Connect the WJ-8712 Receiver and test equipment as illustrated in **Figure 7-7.**

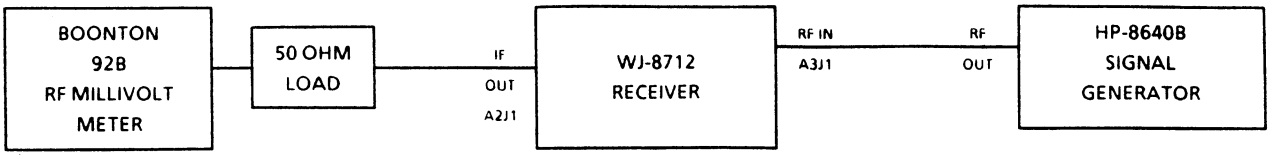



**Figure 7-7. Reconstructed IF Output Performance Test Equipment Connection**

2. Set the signal generator to produce a 15.0000 MHz CW output at a level of -100 dBm.

3. Set the RF millivoltmeter to the -20 dBm range.

4. Set the WJ-8712 Receiver as follows:

| | | |
|---|---|---|
| Tuned Frequency: | 15.000000 MHz | FRQ 15 <Return> |
| Detection Mode: | AM | DET 1 <Return> |
| IF Bandwidth: | 16.0 kHz | BWS 5 <Return> |
| Gain Control: | AGC Slow | AGC 1 <Return> |
| RF Input Path | Normal | RFP 1 <Return> |
| Squelch: | Off | SQL 136 <Return> |

5. Note the IF Output signal level, as indicated on the RF millivoltmeter. Verify that the output level is -20 ±3 dBm (-23 to -17 dBm).

6. While observing the signal level on the RF millivoltmeter, increase the signal generator output level, in 10 dB increments, to an output level of 0 dBm. Verify that throughout the 100 dB change in the RF input signal level, the IF output level -20 ±3 dBm is maintained.

7. Decrease the signal generator output level to -115 dBm.

8. Set the receiver to the Manual Gain mode [ AGC 0 <Return> ] and set the manual gain to maximum [ RFG 127 <Return> ].

9. Adjust the signal generator output level to produce a -20 dBm reference level, as displayed on the RF millivoltmeter (Typical signal generator output level of -112 dBm).

10. Set the receiver manual gain to minimum [ RFG 0 <Return> ].

11. Increase the signal generator output level to +12 dBm and note the signal level indicated on the RF millivoltmeter. Verify that the RF millivoltmeter indication is less than the -20 dBm reference set in step 9, indicating greater than 100 dB of manual gain control.

12. Adjust the signal generator output level to -55 dBm.

13. Set the receiver manual gain to approximately mid-range [ RFG 60 <Return> ].

14. Increase the signal generator output level until a -20 dBm signal level reference is indicated on the RF millivoltmeter. Typically a signal generator output level of approximately -50 dBm is required.

15. While observing the RF millivoltmeter, slowly increase the signal generator frequency until the RF millivoltmeter indication decreases by 3 dB from the reference set in step 14. Note the signal generator frequency at this point.

16. Slowly decrease the signal generator frequency past the 15.0000 MHz tuned frequency and continue until the RF millivoltmeter again displays a 3 dB decrease from the reference level set in step 14. Note the signal generator frequency at this point.

17. Determine the 3 dB bandwidth of the reconstructed IF output by subtracting the value obtained in step 16 from the value obtained in step 15. The calculated bandwidth should be within ±10% of the selected IF bandwidth, as indicated in **Table 7-3.**

**Table 7-3. Selected IF Bandwidth Frequency Ranges**

| IF BW (kHz) | CONTROL COMMAND | BW Min. (kHz) | BW Max. (kHz) |
|---|---|---|---|
| 0.30 | BWS 1<Return> | 0.270 | 0.330 |
| 1.00 | BWS 2<Return> | 0.900 | 1.100 |
| 3.20 | BWS 3<Return> | 2.880 | 3.502 |
| 6.00 | BWS 4<Return> | 5.400 | 6.600 |
| 16.0 | BWS 5<Return> | 14.400 | 17.600 |

18. Set the WJ-8712 Receiver to each of the IF bandwidths listed in **Table 7-3,** and repeat steps 14 through 17 for each selection.

### 7.6.9 RF/IF SIGNAL PATH PERFORMANCE TEST

1. Connect the WJ-8712 Receiver and test equipment as illustrated in **Figure 7-8.**

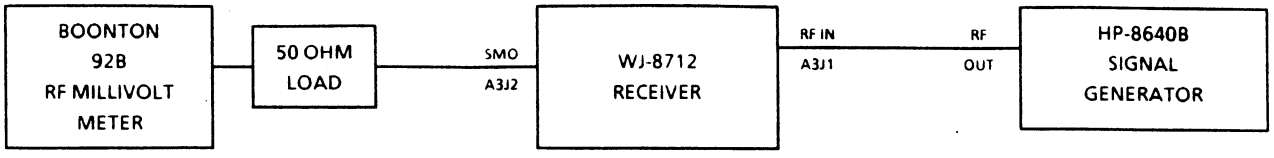



**Figure 7-8. RF/IF Signal Path Performance Test Equipment Connection**

2. Set the signal generator to produce a 10.0000 MHz CW output at a level of -70 dBm.

3. Set the RF millivoltmeter to the -30 dBm range.

4. Set the WJ-8712 Receiver as follows:

| | | |
|---|---|---|
| Tuned Frequency: | 10.000000 MHz | FRQ 10 <Return> |
| Detection Mode: | AM | DET 1 <Return> |
| IF Bandwidth: | 16.0 kHz | BWS 5 <Return> |
| Gain Control: | Manual Gain | AGC 0 <Return> |
| Gain Setting | Mid Range 060 | RFG 60 <Return> |
| RF Input Path | Normal | RFP 1 <Return> |
| Squelch: | Off | SQL 136 <Return> |

5. Adjust the signal generator output level as required to produce a -30 dBm reference level, as indicated on the RF millivoltmeter.

6. Determine the RF Assembly gain by comparing the signal generator output level with the SMO signal level indicated on the RF millivoltmeter. Typically, the signal gain ranges between 25 and 35 dB.

7. While observing the signal level on the RF millivoltmeter, slowly increase the signal generator frequency until decrease of 3 dB, from the reference set in step 5, is observed. Note the signal generator output frequency at this point.

8. Slowly decrease the signal generator frequency past the 10.0000 MHz tuned frequency and continue until the RF millivoltmeter again displays a 3dB decrease in signal level from the reference set in step 5. Note the signal generator output frequency at this point.

9. Determine the 3 dB bandwidth of the RF signal path by subtracting the frequency value obtained in step 8 from the value obtained in step 7. The calculated bandwidth should be at least 0.0300 MHz (30.0 kHz).

10. Return the signal generator output frequency to 10.0000 MHz and adjust the output level as required to obtain a -30 dBm reference level on the RF millivoltmeter.

11. Set the RF Input path of the receiver to the ATTENUATED selection. [ RFP 2 <Return> ]

12. Note the signal level indicated on the RF millivoltmeter. The signal level should decrease by 15±3 dB from the reference level set in step 10.

13. Set the RF millivoltmeter to the -20 dBm range and set the receiver RF Input path to the PREAMPLIFIED selection. [ RFP 3 <Return> ]

14. Note the signal level indicated on the RF millivoltmeter. The signal level should increase by 10±3 dB from the reference set in setup 10.

# SECTION VIII

# REPLACEMENT PARTS LIST

# SECTION VIII

# REPLACEMENT PARTS LIST

## 8.1 UNIT NUMBERING METHOD

The method of numbering used throughout the unit is assigning reference designations (electrical symbol numbers) to identify: assemblies, subassemblies, modules within a subassembly, and discrete components. An example of the unit numbering method used is as follows:

| Subassembly Designation A1 | R1 Class and No. of Item |
|---|---|
| Identify from right to left as: | First (1) resistor (R) of first (1) subassembly (A) |

On the main chassis schematic, components which are an integral part of the main chassis have no subassembly designations.

## 8.2 REFERENCE DESIGNATION PREFIX

The use of partial reference designations are used on the equipment and on the manual illustrations. This partial reference designation consists of the component type letter(s) and the identifying component number. The complete reference designation may be obtained by placing the proper prefix before the partial reference designation. Reference designation prefixes are included on the drawings and illustrations in the figure titles (in parenthesis).

## 8.3 LIST OF MANUFACTURERS

| Mfr. Code | Name and Address | Mfr. Code | Name and Address |
|---|---|---|---|
| 00779 | AMP, Inc.<br>P.O. Box 3608<br>Harrisburg, PA 17150 | 06665 | Precision Monolithics, Inc.<br>1500 Space Park Drive<br>Santa Clara, CA 95050 |
| 01295 | Texas Instruments, Inc.<br>13500 No. Central Express Way<br>Dallas, TX 75231 | 09021 | Airco Electronics<br>Bradford, PA 17055 |
| 04713 | Motorola, Inc.<br>5005 East McDowell Road<br>Phoenix, AZ 85008 | 14632 | Watkins-Johnson Company<br>700 Quince Orchard Road<br>Gaithersburg, MD 20878 |

| Mfr. Code | Name and Address |
|---|---|
| 14778 | Renco Electronics Incorporated<br>60 Jefryn Blvd., E.<br>Deer Park, NY 11729 |
| 15542 | Mini-Circuits Laboratories<br>2625 E. 14th Street<br>Brooklyn, NY 11235 |
| 17856 | Siliconix Incorporated<br>2201 Laurelwood Road<br>Santa Clara, CA 95050 |
| 18324 | Signetics Corporation<br>4130 So. Market Court<br>Sacramento, CA 95834 |
| 20462 | Prem Magnetics Incorporated<br>3521 No. Chapel Hill Road<br>McHenry, IL 60050 |
| 22526 | Dupont Electronics Department<br>Route 83<br>New Cumberland, PA 17070 |
| 24355 | Analog Devices Incorporated<br>Route 1, Industrial Park<br>P.O. Box 280<br>Norwood, MA 02062 |
| 25088 | Siemens America Incorporated<br>186 Wood Avenue<br>So. Iselin, NJ 08830 |
| 26742 | Methode Electronics Incorporated<br>7447 W. Wilson Avenue<br>Chicago, IL 60658-4548 |
| 27014 | National Semi-Conductor Corp.<br>2950 San Ysidro Way<br>Santa Clara, CA 95051 |
| 27264 | Molex Incorporated<br>2222 Welington Court<br>Lisle, IL 60532 |
| 28480 | Hewlett-Packard Company<br>1501 Page Mill Road<br>Palo Alto, CA 94304 |
| 30149 | Standard Crystal Corporation<br>9940 E. Baldwin Place<br>El Monte, CA 91731 |
| 51406 | Murata Erie North America, Inc.<br>1148 Franklin Road, S.E.<br>Marietta, GA 30067 |
| 52648 | Plessey Semiconductors<br>1641 Kaiser Avenue<br>Irvine, CA 92714 |
| 54473 | Panasonic Industrial Company<br>One Panasonic Way<br>P.O. Box 1501<br>Secaucus, NJ 07094 |
| 54583 | TDK Electronics Corporation<br>12 Harbor Park Drive<br>Port Washington, NJ 11550 |
| 55322 | Samtec Incorporated<br>810 Progress Boulevard<br>P.O. Box 1147<br>New Albany, IN 47150 |
| 61271 | Fujitsu Microelectronics, Inc.<br>2985 Kifer Road<br>Santa Clara, CA 95051-0802 |
| 61638 | Advanced Interconnections Corp.<br>5 Division Street<br>West Warwick, RI 02818-3842 |
| 62786 | Hitachi America, LTD.<br>1800 Bering Drive<br>San Jose, CA 95122 |
| 80294 | Bourns Incorporated<br>6135 Magnolia Avenue<br>Riverside, CA 92506 |

| Mfr. Code | Name and Address |
|---|---|
| 9AA37 | JST Corporation<br>1200 Business Center Drive<br>Mt. Prospect, IL 60056 |
| 95146 | Alco Electronics Products, Inc.<br>1551 Osgood Street<br>North Andover, MA 01845 |
| 99800 | Delivan Electronics Div.<br>270 Quaker Road<br>East Aurora, NY 14052-2114 |

## 8.4 PARTS LIST

The following parts lists contain all the electrical components used in the unit, along with mechanical parts which may be subject to unusual wear or damage. When ordering replacement parts from the Watkins-Johnson Company, specify the unit type, the serial number, and the option configuration. Also include the reference designation and the description of each item ordered. The list of manufacturers, provided in **paragraph 8.3**, and the manufacturer's part number, provided in **paragraph 8.5**, are supplied as a guide to aid the user of the equipment while in the field. The parts listed may not necessarily be identical with the parts installed in the unit. The parts listed in **paragraph 8.5** will provide for satisfactory unit operation.

Replacement parts may be obtained from any manufacturer provided that the physical characteristics and electrical parameters of the replacement item are compatible with the original part. In the case where components are defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

**NOTE**

**As improved semiconductors become available, it is the policy of Watkins-Johnson to incorporate them in proprietary products. For this reason some transistors, diodes and integrated circuits installed in the equipment may not agree with those specified in the parts lists and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.**

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## 8.5 TYPE WJ-8712 DIGITAL HF RECEIVER — MAIN CHASSIS

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| | Revision D1 | | | | |
| A1 | Power Interface PC Assembly (Standard) | 1 | 383076-1 | 14632 | |
| A1 | Power Interface PC Assembly (Standard) | | 383076-2 | 14632 | |
| A2 | Digital Control PC Assembly (Standard) | 1 | 797012-1 | 14632 | |
| A2 | Digital Control PC Assembly (Conformal Coated) | | 797012-2 | 14632 | |
| A3 | RF Tuner Assembly (.7 PPM Stability) (Standard) | | 797006-1 | 14632 | |
| A3 | RF Tuner Assembly (.1 PPM Stability) (Conformal Coated) | | 797006-2 | 14632 | |
| A3 | RF Tuner Assembly (.7 PPM Stability) (Conformal Coated) | | 797006-3 | 14632 | |
| A3 | RF Tuner Assembly (.1 PPM Stability) | | 797006-3 | 14632 | |
| B1 | Blower, Fan Assembly | 1 | 383178-1 | 14632 | |
| F1 | Fuse/Cartridge: 1 AMP, 3AG Slow | 1 | MDL1 | 71400 | |
| J1 | Connector, Phone Jack | 1 | 12B | 82389 | |
| PS1 | Power Supply: +5 V @3A, +12 V @ 1.5A and -12 V @.5A | 1 | 841704 | 14632 | |
| PS1 | Power Supply: +5 V @3A, +12 V @ 1.5A and -12 V @.5A (Conformal Coated) | 1 | 841792 | 14632 | |
| R1 | Resistor, Variable Assembly | 1 | 383157-1 | 14632 | |
| S1 | Switch Assembly | 1 | 383156-1 | 14632 | |
| W3 | Cable Assembly | 1 | 383158-1 | 14632 | |

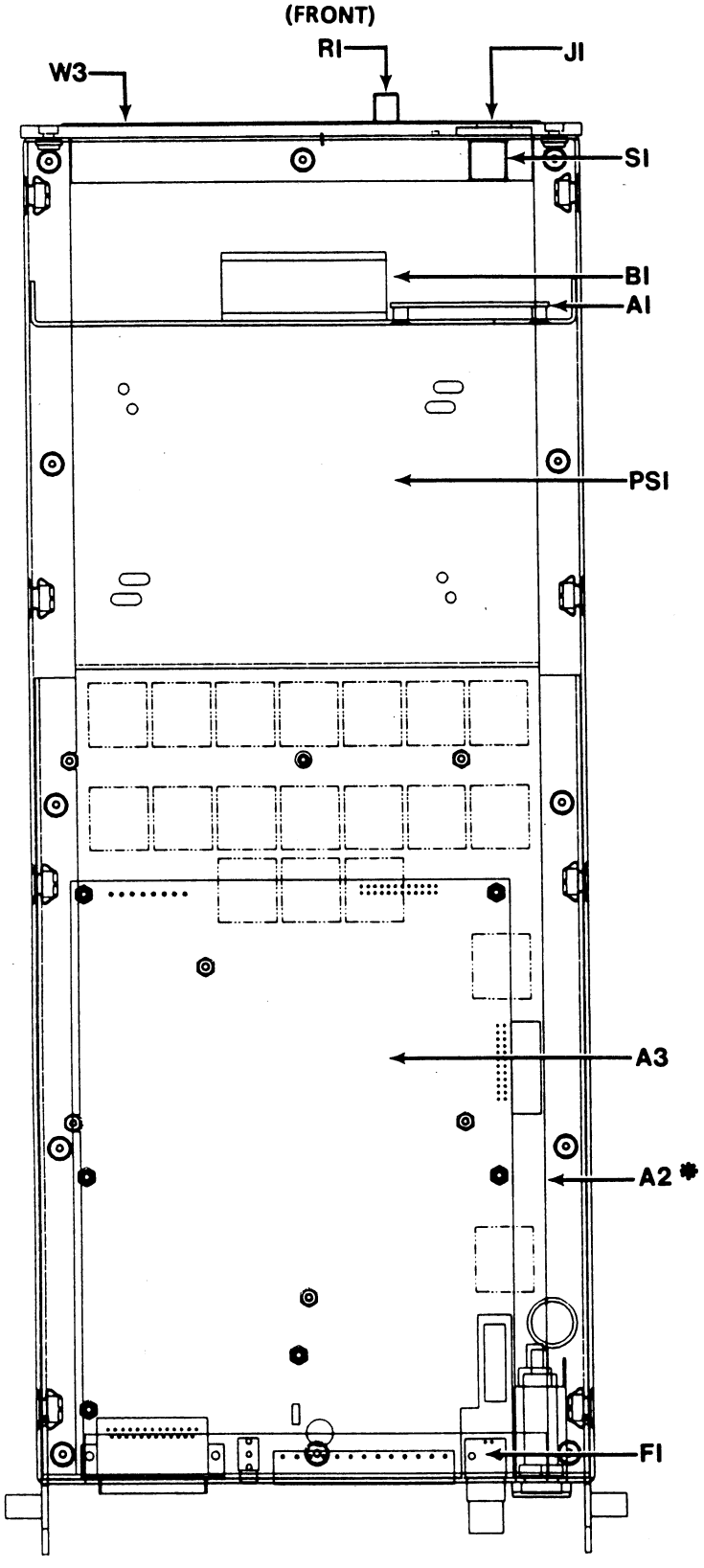


**Figure 8-1. WJ-8712 Top View**

## 8.5.1 TYPE 383076-1/-2 POWER INTERFACE PC ASSEMBLY REF DESIG PREFIX A1

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| | Revision A | | | | |
| | See Note* | | | | |
| C1 | Capacitor, Ceramic, Axial: .1 µF, 50 V, Z5U, ±20% | 3 | SL105E104MAA | 51406 | |
| C2 | Same as C1 | | | | |
| C3 | Same as C1 | | | | |
| C4 | Capacitor, Electrolytic, Aluminum: 470 µF, 16 V | 3 | ECE-A1CU471 | 54473 | |
| C5 | Same as C4 | | | | |
| C6 | Same as C4 | | | | |
| C7 | Not Used | | | | |
| E1 | Terminal | 6 | 42658-3 | 00779 | |
| J1 | Connector, Header | 2 | 26-48-2065 | 27264 | |
| J2 | Connector, Plug | 3 | 640456-3 | 00779 | |
| J3 | Same as J2 | | | | |
| J4 | Same as J2 | | | | |
| J5 | Connector, Header PC Mount | 1 | B6B-PH-K | 9AA37 | |
| J6 | Same as J1 | | | | |
| J7 | Not Used | | | | |
| J8 | Connector | 1 | 79223-624 | 22526 | |
| L1 | Not Used | | | | |
| L2 | Coil, Fixed: 12 µH, 10% | 1 | 1537-38 (14046-5) | 99800 | |
| P1 | Connector, Housing | 1 | 09-50-3061 | 27264 | |
| R1 | Resistor, Fixed, Film: 220Ω, 5%, 1/8 W | 1 | CF1/8-220 OHMS/J | 09021 | |
| R2 | Resistor, Fixed, Film: 47Ω, 5%, 1/8 W | 3 | CF1/8-47 OHMS/J | 09021 | |
| R3 | Same as R2 | | | | |
| R4 | Same as R2 | | | | |

* Note: The Type 383076-1 and Type 383076-2 Assemblies are identical, except the Type 383076-2 is conformal coated.

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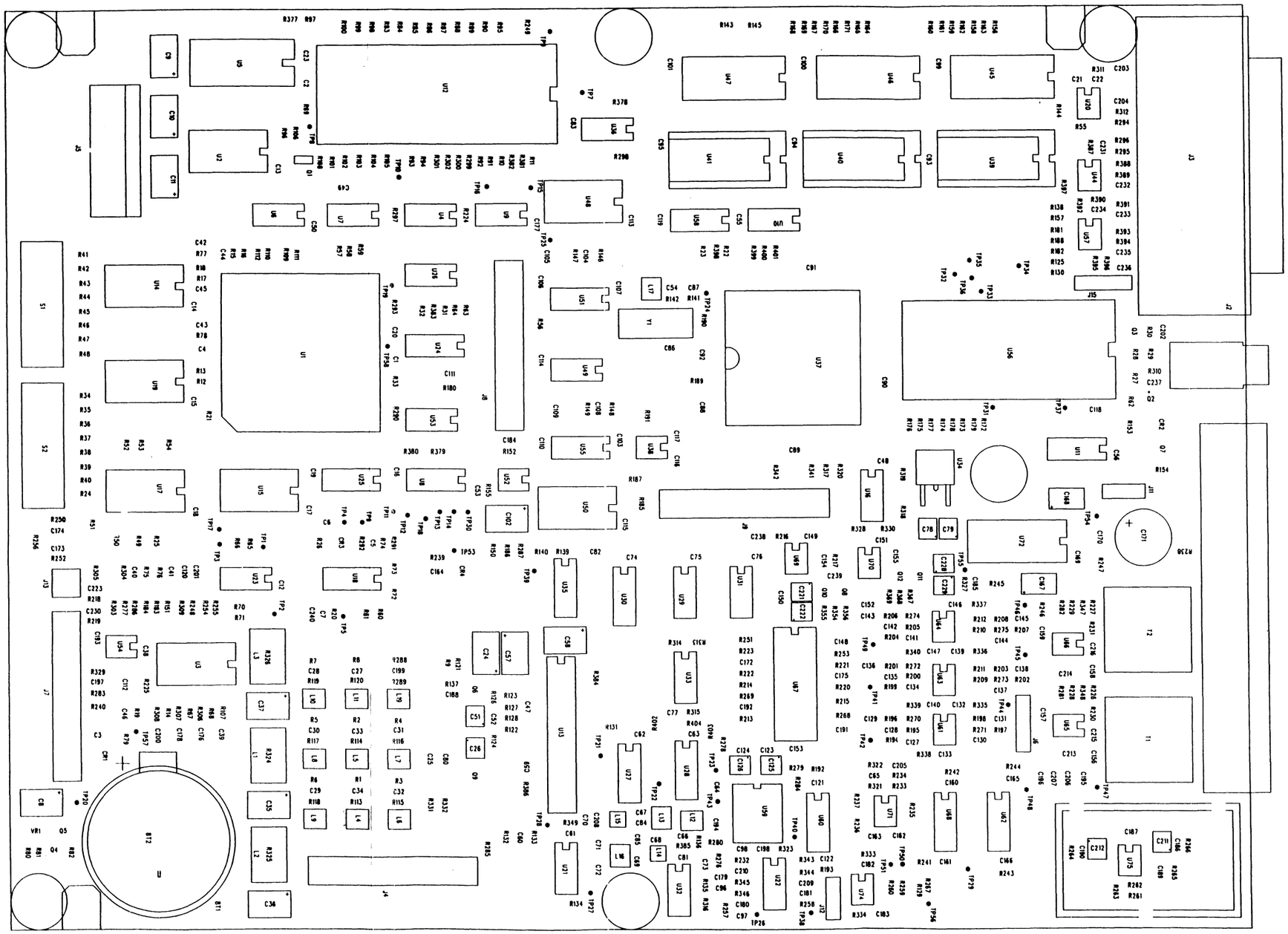

**Figure 8-2.** **Type 797012-X, Digital Assembly (A2), Component Location**

## 8.5.2 TYPE 797012-1/-2 DIGITAL CONTROL PC ASSEMBLY REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| | Revision F1 | | | | |
| | See Note* | | | | |
| BT1 | Not Used | | | | |
| BT2 | Battery, 3 V LITH | 1 | BR2325-3V-LITHIUM | 14632 | |
| C1 | Capacitor, Ceramic: .01 µF, 10%, 50 V | 120 | 841415-019 | 14632 | |
| C2 | Same as C1 | | | | |
| C3 | Not Used | | | | |
| C4 | Same as C1 | | | | |
| C5 | Not Used | | | | |
| C6 | Same as C1 | | | | |
| C7 | Capacitor, Ceramic: .033 µF, 10%, 50 V | 9 | 841415-022 | 14632 | |
| C8 | Capacitor, Tantalum: 33 µF, 20%, 16 V | 10 | 841293-22 | 14632 | |
| C9 Thru C11 | Same as C8 | | | | |
| C12 Thru C23 | Same as C1 | | | | |
| C24 | Same as C8 | | | | |
| C25 | Capacitor, Ceramic: .1 µF, 10%, ≥ 50 Vdc | 7 | 841250-25 | 14632 | |
| C26 | Capacitor, Tantalum: 6.8 µF, 20%, 6.3 V | 2 | 841293-14 | 14632 | |
| C7 Thru C34 | Not Used | | | | |
| C35 Thru C37 | Same as C8 | | | | |
| C38 | Same as C1 | | | | |
| C39 | Capacitor, Ceramic: 100 pF, 5%, 50 V NPO | 5 | 841415-007 | 14632 | |
| C40 Thru C46 | Same as C1 | | | | |
| C47 | Capacitor, Ceramic: 1000 pF, 10%, 50 V | 4 | 841415-013 | 14632 | |
| C48 Thru C50 | Same as C1 | | | | |
| C51 | Same as C26 | | | | |
| C52 | Capacitor, Ceramic: 2200 pF, 10%, 50 V | 4 | 841415-015 | 14632 | |
| C53 | Same as C1 | | | | |
| C54 | Capacitor, Ceramic: 330 pF, 5%, 50 V NPO | 2 | 841415-010 | 14632 | |
| C55 | Same as C1 | | | | |
| C56 | Same as C1 | | | | |
| C57 | Same as C8 | | | | |

* Note: The Type 797012-1 and Type 797012-2 Assemblies are identical, except the Type 797012-2 is conformal coated.

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C58 | Capacitor, Tantalum: 68 µF, 20%, 6.3 V | 1 | 841293-24 | 14632 | |
| C59 Thru C63 | Same as C1 | | | | |
| C64 | Capacitor, Ceramic: 68 pF, ±2%, 50 V NPO | 1 | 841416-045 | 14632 | |
| C65 | Capacitor, Ceramic: 470 pF, 5%, 50 V NPO | 9 | 841415-011 | 14632 | |
| C66 | Capacitor, Ceramic: 820 pF, ±2%, 50 V NPO | 3 | 841416-071 | 14632 | |
| C67 | Capacitor, Ceramic: 100 pF, 2%, 50 V NPO | 4 | 841416-049 | 14632 | |
| C68 | Same as C66 | | | | |
| C69 | Same as C67 | | | | |
| C70 | Capacitor, Ceramic: 1200 pF, 2%, 50 V NPO | 1 | 841416-075 | 14632 | |
| C71 | Capacitor, Ceramic: 56 pF, 2%, 50 V NPO | 1 | 841416-043 | 14632 | |
| C72 Thru C77 | Same as C1 | | | | |
| C78 | Capacitor, Tantalum: 3.3 µF, 20%, 16 V | 10 | 841293-10 | 14632 | |
| C79 | Same as C78 | | | | |
| C80 | Same as C25 | | | | |
| C81 Thru C83 | Same as C1 | | | | |
| C84 | Same as C67 | | | | |
| C85 | Same as C67 | | | | |
| C86 | Capacitor, Ceramic: 47 pF, 5%, 50 V NPO | 2 | 841415-005 | 14632 | |
| C87 | Same as C86 | | | | |
| C88 Thru C95 | Same as C1 | | | | |
| C96 | Same as C65 | | | | |
| C97 | Not Used | | | | |
| C98 | Capacitor, Ceramic: 47 pF, 2%, 50 V NPO | 2 | 841416-041 | 14632 | |
| C99 Thru C101 | Same as C1 | | | | |
| C102 | Same as C8 | | | | |
| C103 Thru C110 | Same as C1 | | | | |
| C111 | Not Used | | | | |
| C112 Thru C124 | Same as C1 | | | | |
| C125 | Same as C78 | | | | |
| C126 | Same as C78 | | | | |
| C127 | Same as C65 | | | | |
| C128 | Same as C66 | | | | |
| C129 | Same as C1 | | | | |
| C130 | Same as C98 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C131 | Same as C65 | | | | |
| C132 | Same as C1 | | | | |
| C133 | Same as C1 | | | | |
| C134 | Same as C47 | | | | |
| C135 | Capacitor, Ceramic: 1500 pF, 10%, 50 V | 2 | 841415-014 | 14632 | |
| C136 | Same as C1 | | | | |
| C137 | Same as C65 | | | | |
| C138 | Same as C65 | | | | |
| C139 | Same as C1 | | | | |
| C140 | Same as C1 | | | | |
| C141 | Same as C47 | | | | |
| C142 | Same as C135 | | | | |
| C143 | Same as C1 | | | | |
| C144 | Same as C65 | | | | |
| C145 | Same as C65 | | | | |
| C146 Thru C153 | Same as C1 | | | | |
| C154 | Capacitor, Ceramic: 22 pF, 5%, 50 V NPO | 5 | 841415-003 | 14632 | |
| C155 | Same as C154 | | | | |
| C156 Thru C166 | Same as C1 | | | | |
| C167 | Capacitor, Tantalum: 10 µF, 20%, 16 V | 2 | 841293-16 | 14632 | |
| C168 | Same as C167 | | | | |
| C169 | Same as C1 | | | | |
| C170 | Same as C7 | | | | |
| C171 | Capacitor, Electrolyic, Aluminum: 470 µF, 16 V | 1 | ECE-A1CU471 | 54473 | |
| C172 Thru C175 | Same as C1 | | | | |
| C176 | Same as C39 | | | | |
| C177 | Same as C1 | | | | |
| C178 | Same as C39 | | | | |
| C179 | Capacitor, Ceramic: 180 pF, 2%, 50 V NPO | 1 | 841416-055 | 14632 | |
| C180 | Same as C52 | | | | |
| C181 | Capacitor, Ceramic: 220 pF, 5%, 50 V NPO | 1 | 841415-009 | 14632 | |
| C182 Thru C184 | Same as C1 | | | | |
| C185 | Same as C47 | | | | |
| C186 | Same as C1 | | | | |
| C187 | Same as C154 | | | | |
| C188 | Same as C1 | | | | |
| C189 | Same as C25 | | | | |
| C190 | Same as C1 | | | | |
| C191 | Same as C52 | | | | |
| C192 | Same as C52 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C193 | Same as C1 | | | | |
| C194 | Same as C1 | | | | |
| C195 | Same as C25 | | | | |
| C196 | Same as C25 | | | | |
| C197 | Same as C1 | | | | |
| C198 | Same as C54 | | | | |
| C199 | Not Used | | | | |
| C200 | Same as C39 | | | | |
| C201 | Same as C39 | | | | |
| C202 Thru C204 | Same as C1 | | | | |
| C205 | Same as C65 | | | | |
| C206 | Same as C25 | | | | |
| C207 | Same as C25 | | | | |
| C208 | Capacitor, Ceramic: 1000 pF, 2%, TOL, 50 V NPO | 1 | 841416-073 | 14632 | |
| C209 | Same as C7 | | | | |
| C210 | Same as C7 | | | | |
| C211 | Same as C78 | | | | |
| C212 | Same as C78 | | | | |
| C213 | Same as C154 | | | | |
| C214 | Same as C154 | | | | |
| C215 | Same as C7 | | | | |
| C216 | Same as C7 | | | | |
| C217 Thru C220 | Not Used | | | | |
| C221 | Same as C78 | | | | |
| C222 | Same as C78 | | | | |
| C223 | Same as C7 | | | | |
| C224 Thru C227 | Not Used | | | | |
| C228 | Same as C78 | | | | |
| C229 | Same as C78 | | | | |
| C230 | Same as C7 | | | | |
| C231 Thru C236 | Not Used | | | | |
| C237 | Capacitor, Ceramic: 75 pF, ±2%, 50 V NPO | 1 | 841416-046 | 14632 | |
| C238 | Capacitor, Ceramic: 36 pF, 2%, 50 V NPO | 2 | 841416-038 | 14632 | |
| C239 | Same as C238 | | | | |
| C240 | Same as C7 | | | | |
| CR1 | Dual Switching Diode | 4 | MMBD7000LT1 | 04713 | |
| CR2 Thru CR4 | Same as CR1 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| FL1 | Filter: 455 kHz | 1 | CFS-455B | 51406 | |
| J1 | Connector, Jack, BNC | 1 | 227677-1 | 00779 | |
| J2 | Phone Jack (CSMA Connector) | 1 | LGY6501-0600 | 14632 | |
| J3 | Connector | 1 | 927F23-01-25-10 | 14632 | |
| J4 | Connector | 4 | 79223-624 | 22526 | |
| J5 | Connector, Header | 1 | 26-48-2066 | 27264 | |
| J6 | Not Used | | | | |
| J7 Thru J9 | Same as J4 | | | | |
| J10 | Not Used | | | | |
| J11 | Connector, PC Board | 1 | 3-102202-4 | 00779 | |
| J12 Thru J14 | Not Used | | | | |
| J15 | Connector | 1 | TSW-104-07-G-S | 55322 | |
| JW1 | Not Used | | | | |
| L1 | Inductor: 10 µH | 3 | RL-1500-10 | 14778 | |
| L2 | Same as L1 | | | | |
| L3 | Same as L1 | | | | |
| L4 Thru L11 | Not Used | | | | |
| L12 | Inductor: 2.2 µH, 5% | 1 | 841444-009 | 14632 | |
| L13 | Inductor: 1.0 µH, 5% | 2 | 841444-001 | 14632 | |
| L14 | Inductor: 150 nH, ±5% | 1 | 841438-029 | 14632 | |
| L15 | Inductor: 68 nH, ±5% | 1 | 841438-021 | 14632 | |
| L16 | Inductor: 2.7 µH, 5% | 1 | 841444-011 | 14632 | |
| L17 | Same as L13 | | | | |
| L18 | Not Used | | | | |
| L19 | Inductor: 1000 µH, 10% | 1 | NLF453232-102K | 54483 | |
| Q1 | Transistor | 5 | MMBT2222ALT1 | 04713 | |
| Q2 Thru Q4 | Same as Q1 | | | | |
| Q5 | Transistor | 1 | MMBT2907ALT1 | 04713 | |
| Q6 | Transistor | 2 | 2N7002 | 17856 | |
| Q7 | Same as Q1 | | | | |
| Q8 | Transistor | 2 | MMBT-3906 | | |
| Q9 | Same as Q6 | | | | |
| Q10 | Transistor | 2 | MMBT3904LT1 | 04713 | |
| Q11 | Same as Q8 | | | | |
| Q12 | Same as Q10 | | | | |
| R1 | Jumper (Resistor) | 37 | 841417 | 14632 | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R2 Thru R8 | Same as R1 | | | | |
| R9 | Resistor, Fixed: 4.7Ω, 5%, 1/10 W | 9 | 841414-089 | 14632 | |
| R10 | Not Used | | | | |
| R11 | Same as R1 | | | | |
| R12 | Resistor, Fixed: 10 kΩ, 5%, 1/10 W | 44 | 841414-097 | 14632 | |
| R13 | Same as R12 | | | | |
| R14 | Resistor, Fixed: 100 kΩ, 5%, 1/10 W | 109 | 841414-121 | 14632 | |
| R15 | Same as R12 | | | | |
| R16 | Resistor, Fixed: 33 kΩ, 5%, 1/10 W | 5 | 841414-109 | 14632 | |
| R17 | Same as R12 | | | | |
| R18 | Resistor, Fixed: 68 kΩ, 5%, 1/10 W | 3 | 841414-117 | 14632 | |
| R19 | Same as R12 | | | | |
| R20 | Same as R14 | | | | |
| R21 Thru R23 | Same as R12 | | | | |
| R24 Thru R26 | Same as R14 | | | | |
| R27 | Same as R12 | | | | |
| R28 | Resistor, Fixed: 47 kΩ, 5%, 1/10 W | 8 | 841414-113 | 14632 | |
| R29 | Same as R28 | | | | |
| R30 | Same as R28 | | | | |
| R31 | Same as R1 | | | | |
| R32 | Same as R1 | | | | |
| R33 Thru R56 | Same as R14 | | | | |
| R57 Thru R61 | Same as R12 | | | | |
| R62 | Same as R9 | | | | |
| R63 | Same as R1 | | | | |
| R64 | Not Used | | | | |
| R65 | Same as R1 | | | | |
| R66 | Not Used | | | | |
| R67 | Same as R14 | | | | |
| R68 | Same as R14 | | | | |
| R69 | Resistor, Fixed: 1.0 kΩ, 5%, 1/10 W | 24 | 841414-073 | 14632 | |
| R70 | Not Used | | | | |
| R71 | Same as R1 | | | | |
| R72 | Same as R1 | | | | |
| R73 | Not Used | | | | |
| R74 | Same as R1 | | | | |
| R75 Thru R77 | Same as R69 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R78 | Not Used | | | | |
| R79 Thru R81 | Same as R69 | | | | |
| R82 | Same as R9 | | | | |
| R83 Thru R106 | Same as R14 | | | | |
| R107 | Resistor, Fixed: 100Ω, 5%, 1/10 W | 13 | 841414-049 | 14632 | |
| R108 | Same as R9 | | | | |
| R109 | Same as R1 | | | | |
| R110 | Same as R1 | | | | |
| R111 | Not Used | | | | |
| R112 | Not Used | | | | |
| R113 Thru R120 | Same as R1 | | | | |
| R121 | Same as R9 | | | | |
| R122 | Resistor, Fixed: 2.2 kΩ, 5%, 1/10 W | 9 | 841414-081 | 14632 | |
| R123 | Same as R122 | | | | |
| R124 | Same as R9 | | | | |
| R125 | Same as R1 | | | | |
| R126 | Same as R28 | | | | |
| R127 | Same as R107 | | | | |
| R128 | Same as R107 | | | | |
| R129 | Same as R9 | | | | |
| R130 | Not Used | | | | |
| R131 | Resistor, Fixed: 10Ω, 5%, 1/10 W | 5 | 841414-025 | 14632 | |
| R132 | Same as R12 | | | | |
| R133 Thru R135 | Same as R14 | | | | |
| R136 Thru R138 | Same as R12 | | | | |
| R139 | Same as R1 | | | | |
| R140 | Same as R1 | | | | |
| R141 | Resistor, Fixed: 1.0 MΩ, 5%, 1/10 W | 4 | 841414-145 | 14632 | |
| R142 | Not Used | | | | |
| R143 | Same as R14 | | | | |
| R144 | Same as R1 | | | | |
| R145 | Not Used | | | | |

REF DESIG PREFIX **A2**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R146 | Resistor, Fixed: 3.3 kΩ, 5%, 1/10 W | 6 | 841414-085 | 14632 | |
| R147 Thru R150 | Same as R146 | | | | |
| R151 | Same as R69 | | | | |
| R152 | Resistor, Fixed: 5.6 kΩ, 5%, 1/10 W | 1 | 841414-091 | 14632 | |
| R153 | Same as R122 | | | | |
| R154 | Same as R14 | | | | |
| R155 | Same as R9 | | | | |
| R156 Thru R181 | Same as R14 | | | | |
| R182 | Same as R12 | | | | |
| R183 | Same as R9 | | | | |
| R184 | Not Used | | | | |
| R185 | Same as R14 | | | | |
| R186 | Same as R1 | | | | |
| R187 | Same as R14 | | | | |
| R188 | Same as R69 | | | | |
| R189 | Same as R14 | | | | |
| R190 | Same as R1 | | | | |
| R191 | Not Used | | | | |
| R192 | Same as R69 | | | | |
| R193 | Same as R69 | | | | |
| R194 | Same as R12 | | | | |
| R195 | Same as R28 | | | | |
| R196 | Same as R69 | | | | |
| R197 | Same as R18 | | | | |
| R198 | Same as R18 | | | | |
| R199 | Resistor, Fixed: 18 kΩ, 5%, 1/10 W | 4 | 841414-103 | 14632 | |
| R200 | Same as R199 | | | | |
| R201 | Same as R122 | | | | |
| R202 | Resistor, Fixed: 75 kΩ, 5%, 1/10 W | 2 | 841414-118 | 14632 | |
| R203 | Same as R16 | | | | |
| R204 | Same as R199 | | | | |
| R205 | Same as R199 | | | | |
| R206 | Same as R122 | | | | |
| R207 | Same as R202 | | | | |
| R208 | Same as R16 | | | | |
| R209 | Resistor, Fixed: 220 kΩ, 5%, 1/10 W | 8 | 841414-129 | 14632 | |
| R210 Thru R212 | Same as R209 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R213 | Same as R28 | | | | |
| R214 | Resistor, Fixed: 22 kΩ, 5%, 1/10 W | 4 | 841414-105 | 14632 | |
| R215 | Same as R214 | | | | |
| R216 | Same as R209 | | | | |
| R217 | Same as R209 | | | | |
| R218 | Resistor, Fixed: 68Ω, 5%, 1/10 W | 2 | 841414-045 | 14632 | |
| R219 | Same as R218 | | | | |
| R220 | Resistor, Fixed: 1.5 kΩ, 5%, 1/10 W | 5 | 841414-077 | 14632 | |
| R221 Thru R223 | Same as R220 | | | | |
| R224 | Same as R14 | | | | |
| R225 | Same as R14 | | | | |
| R226 | Same as R214 | | | | |
| R227 | Same as R214 | | | | |
| R228 | Same as R69 | | | | |
| R229 | Same as R69 | | | | |
| R230 | Same as R107 | | | | |
| R231 | Same as R107 | | | | |
| R232 | Same as R12 | | | | |
| R233 | Resistor, Fixed: 8.2 kΩ, 5%, 1/10 W | 2 | 841414-095 | 14632 | |
| R234 | Same as R233 | | | | |
| R235 | Same as R16 | | | | |
| R236 | Same as R12 | | | | |
| R237 | Same as R28 | | | | |
| R238 | Same as R69 | | | | |
| R239 | Same as R141 | | | | |
| R240 | Resistor, Fixed: 47Ω, 5%, 1/10 W | 20 | 841414-041 | 14632 | |
| R241 Thru R244 | Same as R69 | | | | |
| R245 | Resistor, Fixed: 470Ω, 5%, 1/10 W | 8 | 841414-065 | 14632 | |
| R246 | Same as R245 | | | | |
| R247 | Resistor, Fixed: 2.7Ω, 5%, 1/10 W | 4 | 841414-011 | 14632 | |
| R248 | Same as R14 | | | | |
| R249 | Same as R14 | | | | |
| R250 Thru R253 | Same as R12 | | | | |
| R254 | Same as R14 | | | | |
| R255 | Same as R14 | | | | |
| R256 | Same as R1 | | | | |
| R257 | Same as R12 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R258 | Same as R146 | | | | |
| R259 | Same as R12 | | | | |
| R260 | Same as R12 | | | | |
| R261 | Resistor, Fixed: 680Ω, 5%, 1/10 W | 1 | 841414-069 | 14632 | |
| R262 | Resistor, FIxed: 820Ω, 5%, 1/10 W | 1 | 841414-071 | 14632 | |
| R263 | Same as R220 | | | | |
| R264 Thru R266 | Same as R240 | | | | |
| R267 | Same as R122 | | | | |
| R268 | Same as R240 | | | | |
| R269 | Same as R240 | | | | |
| R270 | Same as R28 | | | | |
| R271 | Not Used | | | | |
| R272 | Not Used | | | | |
| R273 | Same as R209 | | | | |
| R274 | Not Used | | | | |
| R275 | Same as R209 | | | | |
| R276 | Same as R12 | | | | |
| R277 | Resistor, Fixed: 6.8 kΩ, 5%, 1/10 W | 2 | 841414-093 | 14632 | |
| R278 | Same as R131 | | | | |
| R279 | Same as R131 | | | | |
| R280 Thru R282 | Same as R14 | | | | |
| R283 | Same as R141 | | | | |
| R284 | Same as R69 | | | | |
| R285 | Same as R1 | | | | |
| R286 | Not Used | | | | |
| R287 | Same as R1 | | | | |
| R288 | Same as R107 | | | | |
| R289 | Not Used | | | | |
| R290 | Same as R14 | | | | |
| R291 | Same as R14 | | | | |
| R292 | Not Used | | | | |
| R293 | Same as R14 | | | | |
| R294 Thru R296 | Not Used | | | | |
| R297 | Same as R14 | | | | |
| R298 Thru R302 | Same as R12 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R303 | Same as R122 | | | | |
| R304 | Same as R277 | | | | |
| R305 | Same as R122 | | | | |
| R306 Thru R312 | Same as R107 | | | | |
| R313 Thru R316 | Same as R240 | | | | |
| R317 Thru R320 | Same as R14 | | | | |
| R321 | Same as R12 | | | | |
| R322 | Same as R12 | | | | |
| R323 | Resistor, Fixed: 4.7Ω, 5%, 1/10 W | 1 | 841414-017 | 14632 | |
| R324 Thru R326 | Not Used | | | | |
| R327 | Same as R122 | | | | |
| R328 | Same as R14 | | | | |
| R329 | Same as R141 | | | | |
| R330 | Same as R14 | | | | |
| R331 Thru R340 | Same as R240 | | | | |
| R341 | Same as R69 | | | | |
| R342 | Same as R69 | | | | |
| R343 | Same as R16 | | | | |
| R344 | Resistor, Fixed: 150Ω, 5%, 1/10 W | 1 | 841414-053 | 14632 | |
| R345 | Same as R69 | | | | |
| R346 | Resistor, Fixed: 220Ω, 5%, 1/10 W | 1 | 841414-057 | 14632 | |
| R347 | Resistor, Fixed: 2.7 kΩ, 5%, 1/10 W | 2 | 841414-083 | 14632 | |
| R348 | Same as R347 | | | | |
| R349 | Same as R131 | | | | |
| R350 Thru R353 | Not Used | | | | |
| R354 Thru R369 | Same as R245 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R370 Thru R377 | Not Used | | | | |
| R378 Thru R380 | Same as R12 | | | | |
| R381 | Not Used | | | | |
| R382 | Same as R14 | | | | |
| R383 | Same as R1 | | | | |
| R384 | Same as R69 | | | | |
| R385 | Same as R131 | | | | |
| R386 | Same as R1 | | | | |
| R387 Thru R397 | Not Used | | | | |
| R398 Thru R401 | Same as R12 | | | | |
| R402 Thru R404 | Same as R247 | | | | |
| S1 | Switch, DIP | 2 | GDP-08S | 95146 | |
| S2 | Same as S1 | | | | |
| T1 | Transformer | 2 | SPT-130 | 20462 | |
| T2 | Same as T1 | | | | |
| U1 | Integrated Circuit | 1 | MC68HC11A0FN | 04713 | |
| U2 | Integrated Circuit | 1 | 8674HC373SO20W | 14632 | |
| U3 | Integrated Circuit | 4 | 8674HC244SO20W | 14632 | |
| U4 | Integrated Circuit | 1 | 8674HC00SO14U | 14632 | |
| U5 | Integrated Circuit, RAM | 1 | HM6264ALFP | 62786 | |
| U6 | Integrated Circuit, CMOS | 1 | 8674HC4075S014 | 14632 | |
| U7 | Integrated Circuit | 1 | 8674HC27SO14U | 14632 | |
| U8 | Integrated Circuit | 1 | 8674HC138SO16U | 14632 | |
| U9 | Integrated Circuit, CMOS | 2 | 8674HC125SO14U | 14632 | |
| U10 | Integrated Circuit | 1 | 8674F11SO14 | 14632 | |
| U11 | Integrated Circuit | 1 | 8674F138SO16 | 14632 | |
| U12 | EPROM, Programmed | 1 | 841677 | 14632 | |
| U13 | Integrated Circuit | 1 | XC56ADC16S | 04713 | |
| U14 | Same as U3 | | | | |
| U15 | Integrated Circuit | 1 | 8674HC273SO20W | 14632 | |
| U16 | Same as U9 | | | | |
| U17 | Same as U3 | | | | |
| U18 | Integrated Circuit | 1 | 864050SO16N | 14632 | |
| U19 | Same as U3 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| U20 | Integrated Circuit | 2 | SN75155D | 01295 | |
| U21 | Integrated Circuit, CMOS | 3 | 8674AC04SO14U | 14632 | |
| U22 | Amplifier | 1 | 865539SO14 | 14632 | |
| U23 | Integrated Circuit | 3 | 8674HC74SO14U | 14632 | |
| U24 | Integrated Circuit, CMOS | 2 | 8674HC4020SO16U | 14632 | |
| U25 | Integrated Circuit, CMOS | 1 | 8674HC165SO16U | 14632 | |
| U26 | Integrated Circuit, Inverter | 1 | 8674HC04SO14U | 14632 | |
| U27 | Integrated Circuit | 2 | 8674AC161S016U | 14632 | |
| U28 | Same as U27 | | | | |
| U29 | Same as U23 | | | | |
| U30 | Integrated Circuit | 1 | 8674HC161SO16U | 14632 | |
| U31 | Same as U23 | | | | |
| U32 | Same as U21 | | | | |
| U33 | Integrated Circuit, CMOS | 1 | 8674AC74S014 | 14632 | |
| U34 | Voltage Regulator | 1 | MC79M05CDT | 04713 | |
| U35 | Same as U24 | | | | |
| U36 | Same as U21 | | | | |
| U37 | Integrated Circuit, Processor | 1 | XSP56001FE27 | 04713 | |
| U38 | Same as U20 | | | | |
| U39 | Integrated Circuit, Sram, CMOS | 6 | MT5C2568DJ-20 | GY440 | |
| U40 | Same as U39 | | | | |
| U41 | Same as U39 | | | | |
| U44 | Not Used | | | | |
| U45 Thru U47 | Same as U39 | | | | |
| U48 | Integrated Circuit | 2 | 8674HCT273SOL20 | 14632 | |
| U49 | Integrated CIrcuit | 1 | 8674HCT74SO14 | 14632 | |
| U50 | Same as U48 | | | | |
| U51 | Integrated Circuit, DAC | 2 | 86DAC0800S016U | 27014 | |
| U52 | Amplifier | 7 | 8634002SO8 | 14632 | |
| U53 | Integrated Circuit | 1 | 8674HC08SO14U | 14632 | |
| U54 | Same as U52 | | | | |
| U55 | Same as U51 | | | | |
| U56 | EPROM, Programmed | 1 | 841678 | 14632 | |
| U57 | Not Used | | | | |
| U58 | Integrated Circuit | 1 | 8674F139SO16 | 14632 | |
| U59 | Integrated Circuit, Converter, D/A | 1 | AD1851R | 24355 | |
| U60 | Integrated Circuit, CMOS | 3 | 8674HC4053SO16U | 14632 | |
| U61 | Same as U52 | | | | |
| U62 | Same as U60 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| U63 | Same as U52 | | | | |
| U64 | Same as U52 | | | | |
| U65 | Amplifier | 5 | NE5534D | 18324 | |
| U66 | Same as U65 | | | | |
| U67 | Integrated Circuit | 1 | SSM-2122P | 06665 | |
| U68 | Same as U60 | | | | |
| U69 | Same as U65 | | | | |
| U70 | Same as U65 | | | | |
| U71 | Same as U52 | | | | |
| U72 | Integrated Circuit, Amplifier | 1 | LM388N-1 | 27014 | |
| U73 | Not Used | | | | |
| U74 | Same as U52 | | | | |
| U75 | Same as U65 | | | | |
| Y1 | Crystal, Quartz: 27.000 MHz Crystal | 1 | SMX-500-27.000 MHz | 30149 | |
| XBT2 | Battery Holder | 1 | 2S2325-0 w/Foam Pkg. | 14632 | |
| XTB1 | Connector, Header | 1 | ELFH13210 | 14632 | |
| XU1 | Socket | 1 | 213-052-601 | 26742 | |
| XU12 | Socket, DIP | 1 | HLS632-37TG RYTRON | 61638 | |
| XU56 | Socket, DIP | 1 | HLS628-37TG RYTRON | 61638 | |

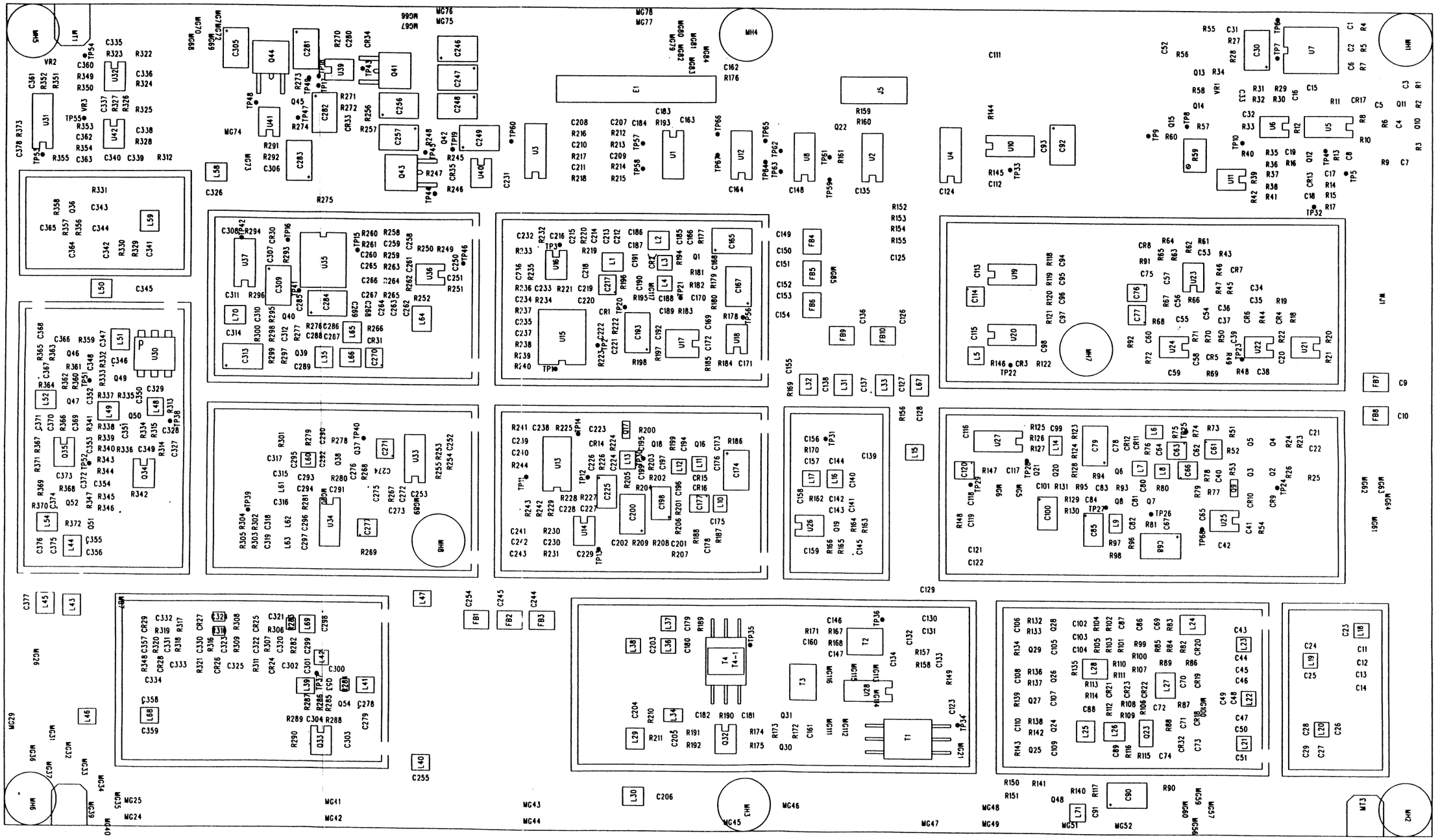

**Figure 8-3. Type 797006-X, RF Assemby (A3), Location of Components**

## 8.5.3 TYPE 797006-1/-2/-3/-4 RF TUNER PC ASSEMBLY REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| | Revision C2 | | | | |
| | See Note* | | | | |
| C1 | Not Used | | | | |
| C2 | Not Used | | | | |
| C3 | Capacitor, Ceramic: .01 µF, 10%, 50 V | 140 | 841415-019 | 14632 | |
| C4 | Same as C3 | | | | |
| C5 | Same as C3 | | | | |
| C6 | Not Used | | | | |
| C7 Thru C10 | Same as C3 | | | | |
| C11 | Capacitor, Ceramic: 56 pF, 2%, 50 V NPO | 4 | 841416-043 | 14632 | |
| C12 | Capacitor, Ceramic: .1 µF, 10% 50 VDC | 80 | 841250-25 | 14632 | |
| C13 | Same as C12 | | | | |
| C14 | Same as C12 | | | | |
| C15 | Same as C3 | | | | |
| C16 | Same as C12 | | | | |
| C17 Thru C22 | Same as C3 | | | | |
| C23 | Capacitor, Ceramic: 160 pF, 2%, 50 V NPO | 2 | 841416-054 | 14632 | |
| C24 | Not Used | | | | |
| C25 | Capacitor, Ceramic: 8.2 pF, ±.25 pF, 50 V | 1 | 8414116-023 | 14632 | |
| C26 | Same as C23 | | | | |
| C27 | Capacitor, Ceramic: 27 pF, 2%, 50 V NPO | 3 | 841416-035 | 14632 | |
| C28 | Same as C11 | | | | |
| C29 | Capacitor, Ceramic: 82 pF, ±2%, 50 V NPO | 3 | 841416-047 | 14632 | |
| C30 | Not Used | | | | |
| C31 | Same as C3 | | | | |
| C32 | Same as C3 | | | | |
| C33 Thru C37 | Same as C12 | | | | |
| C38 | Capacitor, Ceramic: 22 pF, 5%, 50 V NPO | 6 | 841415-003 | 14632 | |
| C39 Thru C41 | Same as C3 | | | | |
| C42 | Same as C38 | | | | |
| C43 | Capacitor, Ceramic: 91 pF, ±2%, 50 V NPO | 2 | 841416-048 | 14632 | |
| C44 | Capacitor, Ceramic: 33 pF, ±2%, 50 V NPO | 1 | 841416-037 | 14632 | |
| C45 | Capacitor, Ceramic: 130 pF, 2%, 50 V NPO | 1 | 841416-052 | 14632 | |

*** Note: The differences between the RF Assembly versions are as follows:**
**Type 797006-1 Standard, .7 PPM Stability**
**Type 797006-2 8712/REF, .1 PPM Stability**
**Type 797006-3 Conformal Coated, .7 PPM Stability**
**Type 797006-4 Conformal Coated, .1 PPM Stability**

REF DESIG PREFIX **A3**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C46 | Same as C43 | | | | |
| C47 | Capacitor, Ceramic: 100 pF, 2%, 50 V NPO | 9 | 841416-049 | 14632 | |
| C48 | Capacitor, Ceramic: 1500 pF, 10%, 50 V | 3 | 841415-014 | 14632 | |
| C49 | Capacitor, Ceramic: 470 pF, 5%, 50 V NPO | 3 | 841415-011 | 14632 | |
| C50 | Not Used | | | | |
| C51 | Same as C47 | | | | |
| C52 | Same as C3 | | | | |
| C53 | Same as C3 | | | | |
| C54 | Same as C12 | | | | |
| C55 | Same as C12 | | | | |
| C56 | Same as C3 | | | | |
| C57 | Same as C38 | | | | |
| C58 | Same as C3 | | | | |
| C59 | Same as C38 | | | | |
| C60 | Same as C3 | | | | |
| C61 | Capacitor, Tantalum: 2.2 µF, 20%, 20 V | 4 | 841293-09 | 14632 | |
| C62 | Same as C3 | | | | |
| C63 | Capacitor, Tantalum: 3.3 µF, 20%, 16 V | 13 | 841293-10 | 14632 | |
| C64 | Same as C3 | | | | |
| C65 | Same as C3 | | | | |
| C66 | Same as C61 | | | | |
| C67 | Same as C3 | | | | |
| C68 | Capacitor, Tantalum: 33 µF, 20%, 16 V | 15 | 841293-22 | 14632 | |
| C69 Thru C75 | Same as C12 | | | | |
| C76 | Same as C61 | | | | |
| C77 | Same as C61 | | | | |
| C78 | Capacitor, Ceramic: 1000 pF, 10%, 50 V | 10 | 841415-013 | 14632 | |
| C79 | Same as C68 | | | | |
| C80 Thru C84 | Same as C3 | | | | |
| C85 | Capacitor, Tantalum: 4.7 µF, 20%, 25 V | 2 | 841293-13 | 14632 | |
| C86 Thru C89 | Same as C12 | | | | |
| C90 | Same as C68 | | | | |
| C91 | Same as C12 | | | | |
| C92 | Not Used | | | | |
| C93 | Same as C3 | | | | |
| C94 | Capacitor, Ceramic: 2200 pF, 10%, 50 V | 7 | 841415-015 | 14632 | |
| C95 | Same as C78 | | | | |
| C96 | Same as C78 | | | | |
| C97 | Same as C94 | | | | |
| C98 | Same as C3 | | | | |
| C99 | Same as C3 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C100 | Not Used | | | | |
| C101 | Same as C3 | | | | |
| C102 Thru C110 | Same as C12 | | | | |
| C111 Thru C113 | Same as C3 | | | | |
| C114 | Capacitor, Tantalum: 6.8 µF, 20%, 6.3 V | 2 | 841293-14 | 14632 | |
| C115 Thru C118 | Same as C3 | | | | |
| C119 | Capacitor, Ceramic: 68 pF, 5%, 50 V NPO | 2 | 841415-006 | 14632 | |
| C120 | Same as C114 | | | | |
| C121 | Same as C12 | | | | |
| C122 | Same as C12 | | | | |
| C123 | Same as C63 | | | | |
| C124 Thru C126 | Same as C3 | | | | |
| C127 Thru C131 | Same as C12 | | | | |
| C132 | Same as C3 | | | | |
| C133 | Same as C12 | | | | |
| C134 | Same as C12 | | | | |
| C135 | Same as C3 | | | | |
| C136 | Same as C3 | | | | |
| C137 | Same as C63 | | | | |
| C138 | Same as C12 | | | | |
| C139 | Same as C3 | | | | |
| C140 | Same as C47 | | | | |
| C141 | Same as C3 | | | | |
| C142 | Same as C47 | | | | |
| C143 | Same as C3 | | | | |
| C144 | Capacitor, Ceramic: 47 pF, 5%, 50 V NPO | 3 | 841415-005 | 14632 | |
| C145 | Same as C63 | | | | |
| C146 | Same as C12 | | | | |
| C147 Thru C154 | Same as C3 | | | | |
| C155 | Same as C12 | | | | |
| C156 | Same as C3 | | | | |
| C157 | Same as C144 | | | | |
| C158 | Same as C3 | | | | |

REF DESIG PREFIX **A3**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C159 | Same as C3 | | | | |
| C160 | Same as C12 | | | | |
| C161 | Same as C12 | | | | |
| C162 | Not Used | | | | |
| C163 | Same as C3 | | | | |
| C164 | Same as C3 | | | | |
| C165 | Not Used | | | | |
| C166 | Same as C3 | | | | |
| C167 | Same as C68 | | | | |
| C168 | Same as C3 | | | | |
| C169 | Same as C3 | | | | |
| C170 | Same as C47 | | | | |
| C171 Thru C173 | Same as C3 | | | | |
| C174 | Not Used | | | | |
| C175 | Same as C49 | | | | |
| C176 | Same as C78 | | | | |
| C177 | Same as C63 | | | | |
| C178 | Same as C78 | | | | |
| C179 | Same as C119 | | | | |
| C180 | Capacitor, Ceramic: 39 pF, 2%, 50 V NPO | 1 | 841416-039 | 14632 | |
| C181 | Same as C12 | | | | |
| C182 | Same as C12 | | | | |
| C183 | Same as C3 | | | | |
| C184 | Not Used | | | | |
| C185 | Same as C47 | | | | |
| c186 | Same as C3 | | | | |
| C187 | Same as C94 | | | | |
| C188 | Same as C144 | | | | |
| C189 | Same as C47 | | | | |
| C190 Thru C192 | Same as C3 | | | | |
| C193 | Not Used | | | | |
| C194 | Same as C78 | | | | |
| C195 Thru C197 | Same as C3 | | | | |
| C198 | Same as C85 | | | | |
| C199 | Same as C3 | | | | |
| C200 | Same as C68 | | | | |
| C201 | Same as C49 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C202 | Not Used | | | | |
| C203 | Same as C47 | | | | |
| C204 | Same as C12 | | | | |
| C205 | Capacitor, Tantalum: .33 µF, 20%, 35 V | 8 | 841293-01 | 14632 | |
| C206 | Same as C12 | | | | |
| C207 Thru C211 | Not Used | | | | |
| C212 | Same as C78 | | | | |
| C213 | Same as C47 | | | | |
| C214 | Same as C3 | | | | |
| C215 | Same as C3 | | | | |
| C216 | Capacitor, Ceramic: .033 µF, 10%, 50 V | 8 | 841415-022 | 14632 | |
| C217 | Same as C63 | | | | |
| C218 | Same as C38 | | | | |
| C219 | Same as C216 | | | | |
| C220 | Same as C3 | | | | |
| C221 | Not Used | | | | |
| C222 | Same as C3 | | | | |
| C223 | Same as C3 | | | | |
| C224 | Not Used | | | | |
| C225 | Not Used | | | | |
| C226 | Same as C3 | | | | |
| C227 | Same as C3 | | | | |
| C228 | Same as C216 | | | | |
| C229 | Same as C3 | | | | |
| C230 | Same as C216 | | | | |
| C231 | Same as C3 | | | | |
| C232 | Not Used | | | | |
| C233 | Same as C3 | | | | |
| C234 Thru C240 | Not Used | | | | |
| C241 Thru C245 | Same as C3 | | | | |
| C246 Thru C249 | Same as C68 | | | | |
| C250 | Same as C216 | | | | |
| C251 | Same as C3 | | | | |
| C252 | Same as C38 | | | | |
| C253 Thru C255 | Same as C3 | | | | |

REF DESIG PREFIX **A3**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C256 | Capacitor, Tantalum: 68 µF, 20%, 6.3 V | 2 | 841293-24 | 14632 | |
| C257 | Same as C68 | | | | |
| C258 | Same as C216 | | | | |
| C259 | Same as C78 | | | | |
| C260 | Same as C78 | | | | |
| C261 | Same as C3 | | | | |
| C262 | Same as C3 | | | | |
| C263 | Same as C94 | | | | |
| C264 | Capacitor, Ceramic: 330 pF, 5%, 50 V NPO | 2 | 841415-010 | 14632 | |
| C265 Thru C267 | Not Used | | | | |
| C268 | Same as C48 | | | | |
| C269 | Same as C94 | | | | |
| C270 | Same as C63 | | | | |
| C271 | Same as C63 | | | | |
| C272 | Same as C3 | | | | |
| C273 | Same as C12 | | | | |
| C274 | Same as C12 | | | | |
| C275 | Same as C63 | | | | |
| C276 | Same as C3 | | | | |
| C277 | Same as C63 | | | | |
| C278 | Same as C205 | | | | |
| C279 | Same as C12 | | | | |
| C280 | Same as C3 | | | | |
| C281 | Same as C68 | | | | |
| C282 | Same as C256 | | | | |
| C283 | Same as C68 | | | | |
| C284 | Same as C68 | | | | |
| C285 | Same as C3 | | | | |
| C286 | Same as C3 | | | | |
| C287 | Same as C78 | | | | |
| C288 | Same as C3 | | | | |
| C289 | Same as C3 | | | | |
| C290 | Same as C12 | | | | |
| C291 | Same as C3 | | | | |
| C292 | Capacitor, Ceramic: 2.2 pF, ±.1 pF, 50 V NPO | 3 | 841416-009 | 14632 | |
| C293 | Same as C292 | | | | |
| C294 | Same as C3 | | | | |
| C295 | Same as C27 | | | | |
| C296 | Same as C3 | | | | |
| C297 | Same as C3 | | | | |

REF DESIG PREFIX **A3**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C298 | Same as C3 | | | | |
| C299 | Same as C11 | | | | |
| C300 | Same as C3 | | | | |
| C301 | Same as C11 | | | | |
| C302 Thru C304 | Same as C3 | | | | |
| C305 | Same as C68 | | | | |
| C306 | Same as C3 | | | | |
| C307 | Same as C3 | | | | |
| C308 | Not Used | | | | |
| C309 | Not Used | | | | |
| C310 Thru C312 | Same as C3 | | | | |
| C313 | Same as C68 | | | | |
| C314 | Not Used | | | | |
| C315 | Same as C27 | | | | |
| C316 | Same as C292 | | | | |
| C317 | Same as C12 | | | | |
| C318 | Capacitor, Ceramic: 22 pF, 2%, 50 V NPO | 2 | 841416-033 | 14632 | |
| C319 | Same as C318 | | | | |
| C320 Thru C325 | Same as C3 | | | | |
| C326 | Same as C12 | | | | |
| C327 | Same as C12 | | | | |
| C328 | Same as C48 | | | | |
| C329 | Same as C264 | | | | |
| C330 Thru C334 | Same as C3 | | | | |
| C335 | Same as C29 | | | | |
| C336 Thru C338 | Same as C3 | | | | |
| C339 | Same as C12 | | | | |
| C340 | Same as C29 | | | | |
| C341 | Same as C12 | | | | |
| C342 | Same as C63 | | | | |
| C343 | Same as C12 | | | | |
| C344 | Same as C63 | | | | |
| C345 | Same as C12 | | | | |
| C346 | Same as C205 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C347 Thru C350 | Same as C12 | | | | |
| C351 | Same as C205 | | | | |
| C352 Thru C354 | Same as C12 | | | | |
| C355 | Same as C205 | | | | |
| C356 | Same as C12 | | | | |
| C357 | Same as C3 | | | | |
| C358 | Same as C205 | | | | |
| C359 | Same as C3 | | | | |
| C360 | Same as C94 | | | | |
| C361 | Same as C216 | | | | |
| C362 | Same as C94 | | | | |
| C363 | Same as C3 | | | | |
| C364 Thru C366 | Same as C12 | | | | |
| C367 | Same as C63 | | | | |
| C368 Thru C370 | Same as C12 | | | | |
| C371 | Same as C205 | | | | |
| C372 | Same as C12 | | | | |
| C373 | Same as C12 | | | | |
| C374 | Same as C205 | | | | |
| C375 Thru C377 | Same as C12 | | | | |
| C378 | Same as C216 | | | | |
| CR1 | Dual Switching Diode | 17 | MMBD7000LT1 | 04713 | |
| CR2 | Diode | 6 | BB620(Q62702-B403) | 25088 | |
| CR3 Thru CR10 | Same as CR1 | | | | |
| CR11 | Same as CR2 | | | | |
| CR12 | Same as CR2 | | | | |
| CR13 | Same as CR1 | | | | |
| CR14 | Same as CR1 | | | | |
| CR15 | Same as CR2 | | | | |
| CR16 | Same as CR2 | | | | |
| CR17 | Same as CR1 | | | | |
| CR18 | Diode | 6 | FDSO1503 | 27014 | |

REF DESIG PREFIX **A3**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| CR19 Thru CR23 | Same as CR18 | | | | |
| CR24 | Diode | 6 | HSMP-3800-T31 | 28480 | |
| CR25 Thru CR29 | Same as CR24 | | | | |
| CR30 | Same as CR1 | | | | |
| CR31 | Same as CR2 | | | | |
| CR32 Thru CR35 | Same as CR1 | | | | |
| E1 | Cable Assembly | 1 | IDMD-12-T-4-C | 55322 | |
| FB1 | Ferrite Bead: 120Ω, ±25% | 10 | CB30-453215T | 54583 | |
| FB2 Thru FB10 | Same as FB1 | | | | |
| FL1 | Filter, BP: 40.455 MHz | 1 | 92609 | 14632 | |
| FL2 | Filter: 455 kHz | 1 | CFS-455B | 51406 | |
| J1 | Connector, Jack, BNC | 3 | 227677-1 | 00779 | |
| J2 | Same as J1 | | | | |
| J3 | Same as J1 | | | | |
| J4 | Not Used | | | | |
| J5 | Connector | 1 | 79223-610 | 22526 | |
| L1 | Inductor: 1000 µH, 10% | 6 | 841699-037 | 14632 | |
| L2 | Inductor: 10 µH, 10% | 2 | 841699-013 | 14632 | |
| L3 | Inductor: 22 nH, ±5% | 1 | 841438-009 | 14632 | |
| L4 | Inductor: 15 nH, ±5% | 1 | 841438-005 | 14632 | |
| L5 | Inductor: 4700 nH, 10% | 12 | 841698-033 | 14632 | |
| L6 | Inductor: 47 µH, ±10% | 2 | NL322522-470K | 54583 | |
| L7 | Inductor: 150 nH, ±5% | 2 | 841438-029 | 14632 | |
| L8 | Inductor: 68 nH, ±5% | 2 | 841438-021 | 14632 | |
| L9 | Inductor: 4.7 µH, ±20% | 4 | B82422-A1472-M | 25088 | |
| L10 | Same as L6 | | | | |
| L11 | Same as L7 | | | | |
| L12 | Same as L8 | | | | |
| L13 | Same as L9 | | | | |
| L14 | Same as L9 | | | | |
| L15 Thru L17 | Same as L5 | | | | |
| L18 | Inductor: 270 µF, ±5% | 2 | 841438-035 | 14632 | |
| L19 | Inductor: 330 nH, ±5% | 1 | 841438-037 | 14632 | |
| L20 | Inductor: 220 nH, ±5% | 4 | 841438-033 | 14632 | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| L21 | Inductor: 160 nH, ±5% | 1 | 841438-030 | 14632 | |
| L22 | Inductor: 180 nH, ±5% | 1 | 841438-031 | 14632 | |
| L23 | Inductor: 240 nH, ±5% | 1 | 841438-034 | 14632 | |
| L24 | Same as L1 | | | | |
| L25 | Inductor: 150 µH, 10% | 2 | 841699-027 | 14632 | |
| L26 | Same as L25 | | | | |
| L27 | Same as L1 | | | | |
| L28 | Same as L1 | | | | |
| L29 | Inductor: 270 µH, 10% | 13 | 841699-030 | 14632 | |
| L30 | Same as L29 | | | | |
| L31 | Inductor: 47 µH, 10% | 4 | 841699-021 | 14632 | |
| L32 | Same as L31 | | | | |
| L33 | Same as L31 | | | | |
| L34 | Same as L9 | | | | |
| L35 | Same as L29 | | | | |
| L36 | Same as L20 | | | | |
| L37 | Inductor: 100 nH, ±5% | 2 | 841438-025 | 14632 | |
| L38 | Same as L37 | | | | |
| L39 | Inductor: 4700 nH, 10% | 1 | 841698-033 | 14632 | |
| L40 | Same as L5 | | | | |
| L41 | Same as L5 | | | | |
| L42 | Same as L18 | | | | |
| L43 Thru L45 | Same as L29 | | | | |
| L46 Thru L48 | Same as L5 | | | | |
| L49 Thru L52 | Same as L29 | | | | |
| L53 | Not Used | | | | |
| L54 | Same as L29 | | | | |
| L55 Thru L57 | Not Used | | | | |
| L58 | Same as L29 | | | | |
| L59 | Same as L29 | | | | |
| L60 | Inductor: 470 nH, ±5% | 2 | 841438-041 | 14632 | |
| L61 | Same as L60 | | | | |
| L62 | Same as L20 | | | | |
| L63 | Same as L20 | | | | |
| L64 | Same as L1 | | | | |
| L65 | Same as L1 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| L66 | Same as L2 | | | | |
| L67 | Same as L31 | | | | |
| L68 | Same as L5 | | | | |
| L69 | Same as L5 | | | | |
| L70 | Not Used | | | | |
| L71 | Same s L5 | | | | |
| Q1 | Transistor | 1 | MMBR2857 | 04713 | |
| Q2 | Transistor | 15 | MMBT3904LT1 | 04713 | |
| Q3 | Same as Q2 | | | | |
| Q4 | Transistor | 18 | MMBT-3906 | 04713 | |
| Q5 | Same as Q4 | | | | |
| Q6 | Transistor | 3 | OST310 | 17856 | |
| Q7 | Transistor | 6 | MMBTH69LT1 | 04713 | |
| Q8 | Same as Q7 | | | | |
| Q9 Thru Q12 | Same as Q2 | | | | |
| Q13 | Same as Q4 | | | | |
| Q14 | Same as Q2 | | | | |
| Q15 | Transistor | 1 | 2N7002 | 17856 | |
| Q16 | Same as Q6 | | | | |
| Q17 | Same as Q7 | | | | |
| Q18 | Same as Q7 | | | | |
| Q19 | Same as Q4 | | | | |
| Q20 | Same as Q7 | | | | |
| Q21 | Same as Q7 | | | | |
| Q22 | Same as Q2 | | | | |
| Q23 | Transistor | 1 | 841381-2 | 14632 | |
| Q24 | Same as Q4 | | | | |
| Q25 | Same as Q2 | | | | |
| Q26 | Same as Q4 | | | | |
| Q27 | Same as Q2 | | | | |
| Q28 | Same as Q4 | | | | |
| Q29 | Same as Q2 | | | | |
| Q30 | Same as Q4 | | | | |
| Q31 | Same as Q4 | | | | |
| Q32 | Transistor | 4 | MRF5812 | 04713 | |
| Q33 Thru Q35 | Same as Q32 | | | | |
| Q36 | Same as Q2 | | | | |

REF DESIG PREFIX **A3**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| Q37 | Transistor | 2 | MMBT3960A | 04713 | |
| Q38 | Same as Q37 | | | | |
| Q39 | Same as Q6 | | | | |
| Q40 | Same as Q4 | | | | |
| Q41 | Transistor | 2 | MTD10N05E | 04713 | |
| Q42 | Same as Q4 | | | | |
| Q43 | Transistor | 1 | MTD4P05 | 04713 | |
| Q44 | Same as Q41 | | | | |
| Q45 | Same as Q2 | | | | |
| Q46 | Same as Q2 | | | | |
| Q47 | Same as Q4 | | | | |
| Q48 | Same as Q2 | | | | |
| Q49 Thru Q54 | Same as Q4 | | | | |
| R1 | Resistor, Fixed: 1.0 kΩ, 5%, 1/10 W | 29 | 841414-073 | 14632 | |
| R2 | Resistor, Fixed: 680Ω, 5%, 1/10 W | 22 | 841414-069 | 14632 | |
| R3 | Same as R1 | | | | |
| R4 | Jumper | 26 | 841417 | 14632 | |
| R5 | Same as R4 | | | | |
| R6 | Same as R2 | | | | |
| R7 | Same as R4 | | | | |
| R8 | Resistor, Fixed: 100 kΩ, 5%, 1/10 W | 14 | 841414-121 | 14632 | |
| R9 | Same as R2 | | | | |
| R10 | Resistor, Fixed: 10Ω, 5%, 1/10 W | 35 | 841414-025 | 14632 | |
| R11 | Resistor, Fixed: 10 kΩ, 5%, 1/10 W | 19 | 841414-097 | 14632 | |
| R12 | Same as R11 | | | | |
| R13 | Same as R1 | | | | |
| R14 | Same as R8 | | | | |
| R15 | Resistor, Fixed: 1.5 MΩ, 5%, 1/10 W | 5 | 841414-149 | 14632 | |
| R16 | Same as R10 | | | | |
| R17 | Resistor, Fixed: 680 kΩ, 5%, 1/10 W | 5 | 841414-141 | 14632 | |
| R18 | Resistor, Fixed: 6.8 kΩ, 5%, 1/10 W | 5 | 841414-093 | 146732 | |
| R19 | Resistor, Fixed: 120 kΩ, 5%, 1/10 W | 2 | 841414-123 | 14632 | |
| R20 | Resistor, Fixed: 12 kΩ, 5%, 1/10 W | 6 | 841414-099 | 14632 | |
| R21 | Resistor, Fixed: 4.7 kΩ, 5%, 1/10 W | 16 | 841414-089 | 14632 | |
| R22 | Same as R10 | | | | |
| R23 | Same as R20 | | | | |
| R24 | Resistor, Fixed: 27 kΩ, 5%, 1/10 W | 6 | 841414-107 | 14632 | |
| R25 | Same as R20 | | | | |
| R26 | Same as R24 | | | | |
| R27 | Same as R21 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R28 | Same as R10 | | | | |
| R29 | Resistor, Fixed: 68 kΩ, 5%, 1/10 W | 2 | 841414-117 | 14632 | |
| R30 | Same as R15 | | | | |
| R31 | Same as R29 | | | | |
| R32 | Same as R15 | | | | |
| R33 | Same as R10 | | | | |
| R34 | Resistor, Fixed: 2.2 kΩ, 5%, 1/10 W | 8 | 841414-081 | 14632 | |
| R35 | Same as R15 | | | | |
| R36 | Same as R15 | | | | |
| R37 | Same as R17 | | | | |
| R38 | Not Used | | | | |
| R39 | Same as R11 | | | | |
| R40 | Resistor, Fixed: 330Ω, 5%, 1/10 W | 7 | 841414-061 | 14632 | |
| R41 | Same as R8 | | | | |
| R42 | Resistor, Fixed: 3.3 kΩ, 1/10 W | 10 | 841414-085 | 14632 | |
| R43 | Same as R1 | | | | |
| R44 | Resistor, Fixed: 470Ω, 5%, 1/10 W | 19 | 841414-065 | 14632 | |
| R45 | Same as R1 | | | | |
| R46 | Resistor, Fixed: 15 kΩ, 5%, 1/10 W | 5 | 841414-101 | 14632 | |
| R47 | Not Used | | | | |
| R48 | Same as R11 | | | | |
| R49 | Same as R19 | | | | |
| R50 | Same as R10 | | | | |
| R51 | Same as R42 | | | | |
| R52 | Resistor, Fixed: 100Ω, 5%, 1/10 W | 17 | 841414-049 | 14632 | |
| R53 | Same as R52 | | | | |
| R54 | Same as R10 | | | | |
| R55 | Same as R8 | | | | |
| R56 | Resistor, Fixed: 22 kΩ, 5%, 1/10 W | 3 | 841414-105 | 14632 | |
| R57 | Same as R8 | | | | |
| R58 | Same as R56 | | | | |
| R59 | Resistor, Variable: 10 kΩ | 1 | 3269X-1-103 | 80294 | |
| R60 | Same as R11 | | | | |
| R61 | Same as R10 | | | | |
| R62 | Same as R46 | | | | |
| R63 | Same as R1 | | | | |
| R64 | Same as R1 | | | | |
| R65 | Not Used | | | | |
| R66 | Resistor, Fixed: 470 kΩ, 5%, 1/10 W | 2 | 841414-137 | 14632 | |
| R67 | Same as R10 | | | | |
| R68 | Same as R11 | | | | |

REF DESIG PREFIX **A3**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R69 | Same as R18 | | | | |
| R70 | Same as R44 | | | | |
| R71 | Same as R10 | | | | |
| R72 | Same as R10 | | | | |
| R73 | Same as R1 | | | | |
| R74 | Same as R52 | | | | |
| R75 | Same as R34 | | | | |
| R76 | Same as R8 | | | | |
| R77 | Same as R11 | | | | |
| R78 | Same as R11 | | | | |
| R79 | Same as R10 | | | | |
| R80 | Resistor, Fixed: 1.5 kΩ, 5%, 1/10 W | 12 | 841414-077 | 14632 | |
| R81 | Resistor, Fixed: 150Ω, 5%, 1/10 W | 6 | 841414-053 | 14632 | |
| R82 | Resistor, Fixed: 470Ω, 5%, 1/8 W | 3 | 841296-057 | 14632 | |
| R83 | Same as R44 | | | | |
| R84 | Same as R82 | | | | |
| R85 | Same as R82 | | | | |
| R86 | Same as R24 | | | | |
| R87 | Resistor, Fixed: 120Ω, 5%, 1/10 W | 4 | 841414-051 | 14632 | |
| R88 | Resistor, Fixed: 270Ω, 5%, 1/10 W | 2 | 841414-059 | 14632 | |
| R89 | Same as R24 | | | | |
| R90 | Same as R21 | | | | |
| R91 | Same as R66 | | | | |
| R92 | Same as R44 | | | | |
| R93 | Same as R2 | | | | |
| R94 | Same as R81 | | | | |
| R95 | Resistor, Fixed: 22Ω, 5%, 1/10 W | 7 | 841414-033 | 14632 | |
| R96 | Same as R52 | | | | |
| R97 | Same as R34 | | | | |
| R98 | Same as R80 | | | | |
| R99 | Resistor, Fixed: 120Ω, 5%, 1/8 W | 5 | 841296-043 | 14632 | |
| R100 | Same as R99 | | | | |
| R101 | Same as R99 | | | | |
| R102 | Same as R81 | | | | |
| R103 | Same as R99 | | | | |
| R104 | Resistor, Fixed: 180Ω, 5%, 1/10 W | 5 | 841414-055 | 14632 | |
| R105 | Same as R52 | | | | |
| R106 | Same as R10 | | | | |
| R107 | Same as R99 | | | | |
| R108 | Same as R95 | | | | |
| R109 | Same as R10 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R110 | Same as R87 | | | | |
| R111 | Same as R52 | | | | |
| R112 | Same as R10 | | | | |
| R113 | Same as R24 | | | | |
| R114 | Resistor, Fixed: 220Ω, 5%, 1/10 W | 10 | 841414-057 | 14632 | |
| R115 | Same as R114 | | | | |
| R116 | Same as R2 | | | | |
| R117 | Resistor, Fixed: 47Ω, 5%, 1/10 W | 15 | 841414-041 | 14632 | |
| R118 | Same as R87 | | | | |
| R119 | Same as R1 | | | | |
| R120 | Same as R1 | | | | |
| R121 | Same as R87 | | | | |
| R122 | Same as R1 | | | | |
| R123 | Resistor, Fixed: 68Ω, 5%, 1/10 W | 5 | 841414-045 | 14632 | |
| R124 | Same as R123 | | | | |
| R125 Thru R127 | Same as R44 | | | | |
| R128 | Same as R123 | | | | |
| R129 | Same as R80 | | | | |
| R130 | Same as R1 | | | | |
| R131 | Same as R44 | | | | |
| R132 | Same as R21 | | | | |
| R133 | Resistor, Fixed: 33 kΩ, 5%, 1/10 W | 3 | 841414-109 | 14632 | |
| R134 | Same as R21 | | | | |
| R135 | Same as R44 | | | | |
| R136 | Same as R21 | | | | |
| R137 | Same as R133 | | | | |
| R138 | Same as R21 | | | | |
| R139 | Same as R21 | | | | |
| R140 | Same as R114 | | | | |
| R141 | Same as R21 | | | | |
| R142 | Same as R133 | | | | |
| R143 | Same as R21 | | | | |
| R144 | Same as R10 | | | | |
| R145 Thru R147 | Same as R8 | | | | |
| R148 | Same as R114 | | | | |
| R149 | Resistor, Fixed: 2.7 kΩ, 5%, 1/10 W | 8 | 841414-083 | 14632 | |
| R150 Thru R152 | Same as R21 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R153 | Same as R24 | | | | |
| R154 | Same as R20 | | | | |
| R155 | Same as R8 | | | | |
| R156 | Same as R10 | | | | |
| R157 | Same as R11 | | | | |
| R158 | Same as R149 | | | | |
| R159 | Same as R11 | | | | |
| R160 | Same as R21 | | | | |
| R161 | Same as R21 | | | | |
| R162 | Same as R52 | | | | |
| R163 | Same as R42 | | | | |
| R164 | Same as R44 | | | | |
| R165 | Same as R10 | | | | |
| R166 | Same as R88 | | | | |
| R167 | Same as R149 | | | | |
| R168 | Same as R42 | | | | |
| R169 | Same as R10 | | | | |
| R170 | Same as R1 | | | | |
| R171 | Same as R149 | | | | |
| R172 | Same as R42 | | | | |
| R173 | Resistor, Fixed: 560Ω, 5%, 1/10 W | 5 | 841414-067 | 14632 | |
| R174 | Same as R42 | | | | |
| R175 | Not Used | | | | |
| R176 | Same as R4 | | | | |
| R177 | Same as R114 | | | | |
| R178 | Same as R149 | | | | |
| R179 | Same as R10 | | | | |
| R180 | Same as R2 | | | | |
| R181 | Same as R117 | | | | |
| R182 | Same as R80 | | | | |
| R183 | Same as R2 | | | | |
| R184 | Same as R10 | | | | |
| R185 | Not Used | | | | |
| R186 | Same as R81 | | | | |
| R187 | Same as R40 | | | | |
| R188 | Same as R81 | | | | |
| R189 | Same as R117 | | | | |
| R190 | Same as R2 | | | | |
| R191 | Resistor, Fixed: 3.3Ω, 5%, 1/10 W | 2 | 841414-013 | 14632 | |
| R192 | Same as R191 | | | | |
| R193 | Same as R4 | | | | |

REF DESIG PREFIX **A3**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R194 | Resistor, Fixed: 33Ω, 5%, 1/10 W | 4 | 841414-037 | 14632 | |
| R195 | Same as R34 | | | | |
| R196 | Same as R8 | | | | |
| R197 | Same as R10 | | | | |
| R198 | Same as R10 | | | | |
| R199 | Same as R2 | | | | |
| R200 | Same as R2 | | | | |
| R201 | Same as R1 | | | | |
| R202 | Same as R46 | | | | |
| R203 | Same as R52 | | | | |
| R204 | Same as R117 | | | | |
| R205 | Same as R44 | | | | |
| R206 | Same as R8 | | | | |
| R207 | Same as R40 | | | | |
| R208 | Same as R44 | | | | |
| R209 | Same as R4 | | | | |
| R210 | Same as R194 | | | | |
| R211 | Same as R117 | | | | |
| R212 | Same as R2 | | | | |
| R213 | Same as R42 | | | | |
| R214 | Same as R2 | | | | |
| R215 | Same as R42 | | | | |
| R216 Thru R218 | Same as R4 | | | | |
| R219 | Same as R10 | | | | |
| R220 | Same as R114 | | | | |
| R221 | Same as R42 | | | | |
| R222 | Same as R4 | | | | |
| R223 | Same as R2 | | | | |
| R224 | Same as R4 | | | | |
| R225 | Same as R4 | | | | |
| R226 | Same as R10 | | | | |
| R227 | Same as R10 | | | | |
| R228 | Same as R2 | | | | |
| R229 | Same as R1 | | | | |
| R230 | Same as R1 | | | | |
| R231 | Same as R10 | | | | |
| R232 | Same as R42 | | | | |
| R233 | Same as R80 | | | | |
| R234 | Same as R10 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R235 | Same as R80 | | | | |
| R236 Thru R241 | Same as R4 | | | | |
| R242 | Same as R1 | | | | |
| R243 | Same as R1 | | | | |
| R244 | Same as R4 | | | | |
| RR245 | Same as R17 | | | | |
| R246 Thru R248 | Same as R11 | | | | |
| R249 | Resistor, Fixed: 5.6 kΩ, 5%, 1/10 W | 6 | 841414-091 | 14632 | |
| R250 | Same as R249 | | | | |
| R251 | Same as R10 | | | | |
| R252 | Same as R44 | | | | |
| R253 | Same as R114 | | | | |
| R254 | Same as R117 | | | | |
| R255 | Same as R8 | | | | |
| R256 | Same as R1 | | | | |
| R257 | Same as R46 | | | | |
| R258 Thru R261 | Same as R2 | | | | |
| R262 | Same as R10 | | | | |
| R263 Thru R265 | Same as R4 | | | | |
| R266 | Same as R11 | | | | |
| R267 | Same as R10 | | | | |
| R268 | Same as R34 | | | | |
| R269 | Same as R10 | | | | |
| R270 | Same as R21 | | | | |
| R271 | Same as R17 | | | | |
| R272 | Same as R56 | | | | |
| R273 | Same as R11 | | | | |
| R274 | Same as R17 | | | | |
| R275 | Same as R2 | | | | |
| R276 | Same as R52 | | | | |
| R277 | Same as R2 | | | | |
| R278 | Same as R1 | | | | |
| R279 | Same as R1 | | | | |
| R280 | Same as R34 | | | | |
| R281 | Same as R8 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R282 | Same as R117 | | | | |
| R283 | Same as R1 | | | | |
| R284 | Same as R95 | | | | |
| R285 | Same as R1 | | | | |
| R286 | Same as R18 | | | | |
| R287 | Same as R80 | | | | |
| R288 | Same as R249 | | | | |
| R289 | Same as R173 | | | | |
| R290 | Resistor, Fixed: 2.7Ω, 5%, 1/10 W | 2 | 841414-011 | 14632 | |
| R291 | Same as R11 | | | | |
| R292 | Same as R11 | | | | |
| R293 | Same as R10 | | | | |
| R294 | Same as R4 | | | | |
| R295 | Same as R44 | | | | |
| R296 | Same as R4 | | | | |
| R297 | Same as R114 | | | | |
| R298 | Same as R11 | | | | |
| R299 | Same as R34 | | | | |
| R300 | Same as R52 | | | | |
| R301 | Same as R52 | | | | |
| R302 | Same as R123 | | | | |
| R303 | Same as R123 | | | | |
| R304 | Same as R104 | | | | |
| R305 | Same as R104 | | | | |
| R306 | Same as R40 | | | | |
| R307 | Same as R117 | | | | |
| R308 | Same as R1 | | | | |
| R309 | Same as R117 | | | | |
| R310 | Same as R40 | | | | |
| R311 | Same as R149 | | | | |
| R312 | Same as R95 | | | | |
| R313 | Same as R117 | | | | |
| R314 | Same as R80 | | | | |
| R315 | Same as R18 | | | | |
| R316 | Same as R117 | | | | |
| R317 | Same as R1 | | | | |
| R318 | Same as R117 | | | | |
| R319 | Same as R40 | | | | |
| R320 | Same as R117 | | | | |
| R321 | Same as R149 | | | | |
| R322 | Same as R4 | | | | |

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R323 | Same as R20 | | | | |
| R324 | Same as R52 | | | | |
| R325 | Same as R4 | | | | |
| R326 | Same as R20 | | | | |
| R327 | Same as R80 | | | | |
| R328 | Same as R52 | | | | |
| R329 | Same as R173 | | | | |
| R330 | Same as R173 | | | | |
| R331 | Same as R95 | | | | |
| R332 | Same as R52 | | | | |
| R333 | Same as R95 | | | | |
| R334 | Same as R249 | | | | |
| R335 | Same as R1 | | | | |
| R336 | Same as R173 | | | | |
| R337 | Same as R52 | | | | |
| R338 | Same as R104 | | | | |
| R339 | Same as R114 | | | | |
| R340 | Same as R44 | | | | |
| R341 | Same as R117 | | | | |
| R342 | Same as R290 | | | | |
| R343 | Same as R44 | | | | |
| R344 | Same as R44 | | | | |
| R345 | Same as R18 | | | | |
| R346 | Same as R80 | | | | |
| R347 | Same as R1 | | | | |
| R348 | Same as R149 | | | | |
| R349 | Same as R44 | | | | |
| R350 | Same as R52 | | | | |
| R351 | Same as R34 | | | | |
| R352 | Same as R2 | | | | |
| R353 | Same as R44 | | | | |
| R355 | Same as R52 | | | | |
| R355 | Same as R11 | | | | |
| R356 | Same as R1 | | | | |
| R357 | Same as R1 | | | | |
| R358 | Same as R80 | | | | |
| R359 | Same as R80 | | | | |
| R360 | Same as R114 | | | | |
| R361 | Same as R117 | | | | |
| R362 | Same as R81 | | | | |
| R363 | Same as R249 | | | | |
| R364 | Same as R104 | | | | |

REF DESIG PREFIX **A3**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R365 | Same as R46 | | | | |
| R366 | Same as R194 | | | | |
| R367 | Same as R10 | | | | |
| R368 | Same as R249 | | | | |
| R369 | Same as R194 | | | | |
| R370 | Same as R40 | | | | |
| R371 | Same as R10 | | | | |
| R372 | Same as R95 | | | | |
| R373 | Same as R2 | | | | |
| R374 | Resistor, Fixed: 180Ω, 5%, 1/8 W | 1 | 841296-047 | 14632 | |
| T1 | Transformer | 1 | 841709-1 | 14632 | |
| T2 | Transformer | 2 | 458DB-1011 = P1 | 9AA39 | |
| T3 | Same as T2 | | | | |
| T4 | Transformer | 1 | 458PS-1007 = T1 | 9AA39 | |
| U1 | Integrated Circuit | 1 | 8674HC08SO14U | 14632 | |
| U2 | Integrated Circuit | 2 | 8674HC32SO14U | 14632 | |
| U3 | Integrated Circuit | 1 | 8674HC138SO16U | 14632 | |
| U4 | Integrated Circuit/CMOS | 1 | 8674HC4094SO16U | 14632 | |
| U5 | Integrated Circuit | 2 | 8674HC00SO14U | 14632 | |
| U6 | Amplifier | 1 | 86062SO8 | 14632 | |
| U7 | Integrated Circuit | 3 | MC145158DW-2 | 04713 | |
| U8 | Integrated Circuit | 1 | 8674HC02SO14U | 14632 | |
| U9 | OSC/TCVXO, ±0.6 PPM* | 1 | 92658 | 14632 | |
| U9 | TCXO/XTAL 10.000 MHz** | | 92549 | 14632 | |
| U10 | Integrated Circuit/CMOS | 3 | 8674AC00SO14U | 14632 | |
| U11 | Integrated Circuit | 1 | TL431CD | 04713 | |
| U12 | Same as U2 | | | | |
| U13 | Integrated Circuit/CMOS | 1 | MB87086APF | 61271 | |
| U14 | Amplifier | 10 | NE5534D | 18324 | |
| U15 | Same as U7 | | | | |
| U16 | Same as U14 | | | | |
| U17 | Integrated Circuit | 1 | MB504PF | 61271 | |
| U18 | Integrated Circuit | 1 | SP8792/MP | 52648 | |
| U19 | Integrated Circuit/CMOS | 1 | 8674AC74S014 | 14632 | |
| U20 | Same as U5 | | | | |
| U21 Thru U25 | Same as U14 | | | | |

* Note: *Type 797006-1/-3
**Type 797006-2/-4

# SECTION IX

# SCHEMATIC DIAGRAMS

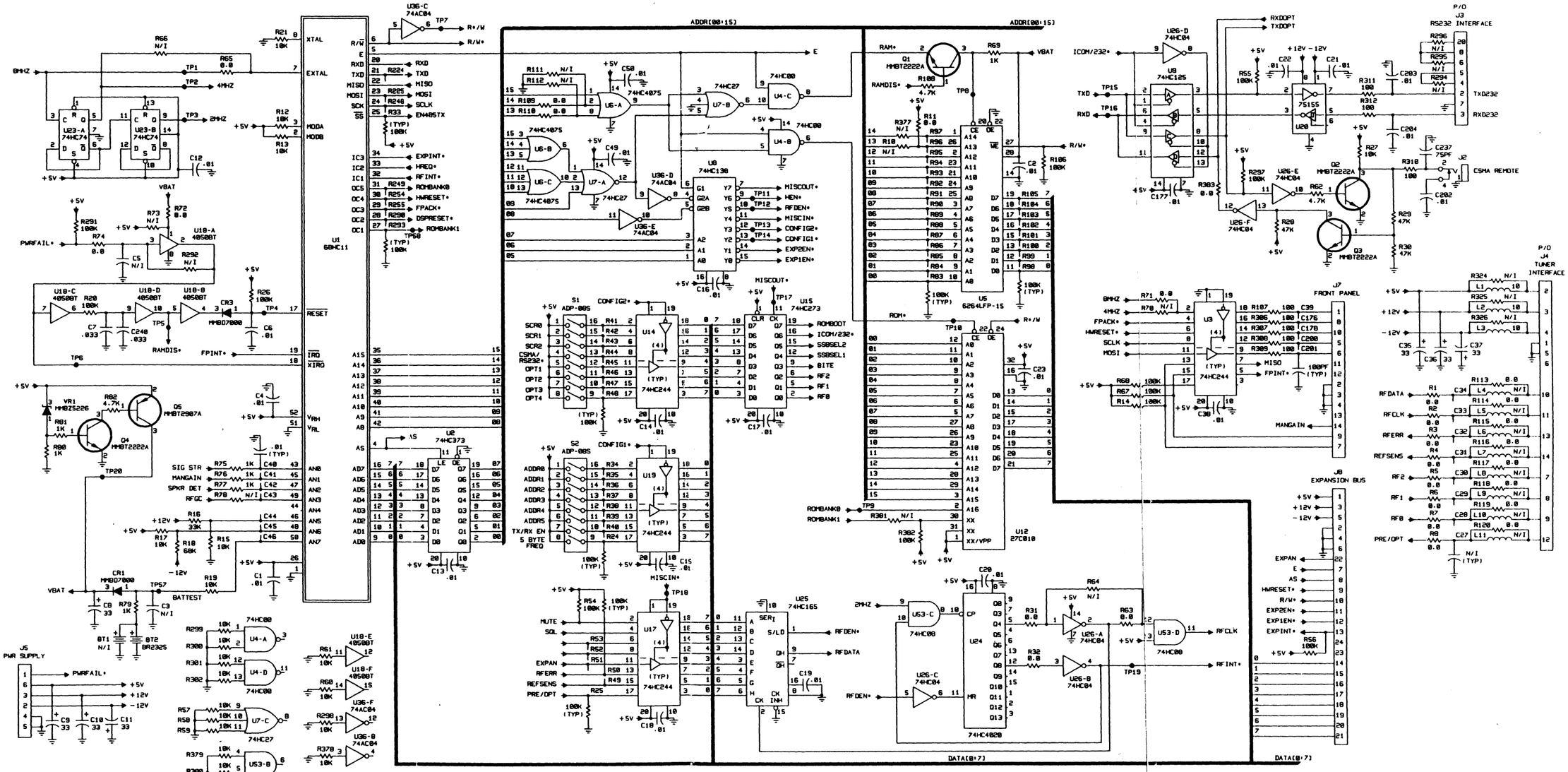


**Figure 9-1. Type 797012-1, Digital Control Assembly (A2), Schematic Diagram 581283 (Sheet 1 of 4) (H)**

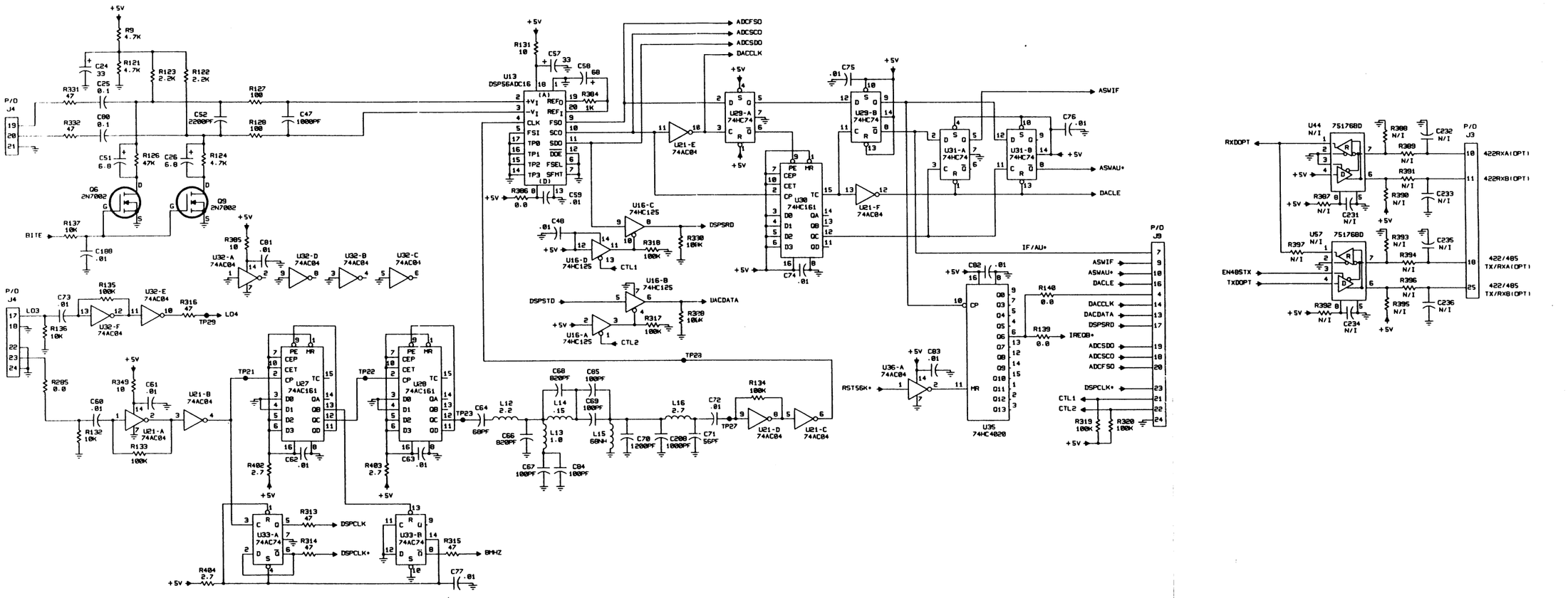


**Figure 9-1. Type 797012-1, Digital Control Assembly (A2), Schematic Diagram 581283 (Sheet 2 of 4) (H)**

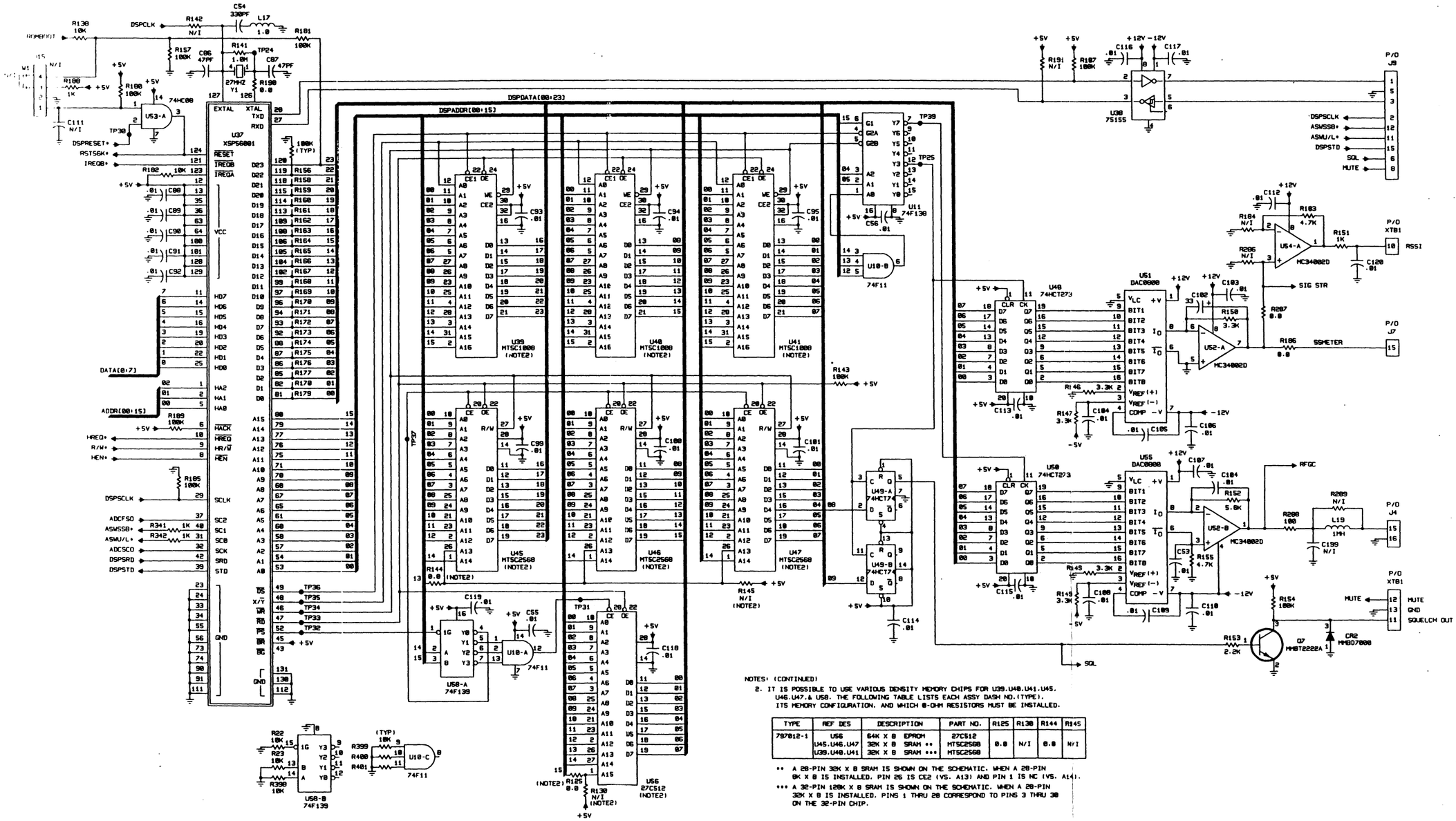


**Figure 9-1. Type 797012-1, Digital Control Assembly (A2), Schematic Diagram 581283 (Sheet 3 of 4) (H)**

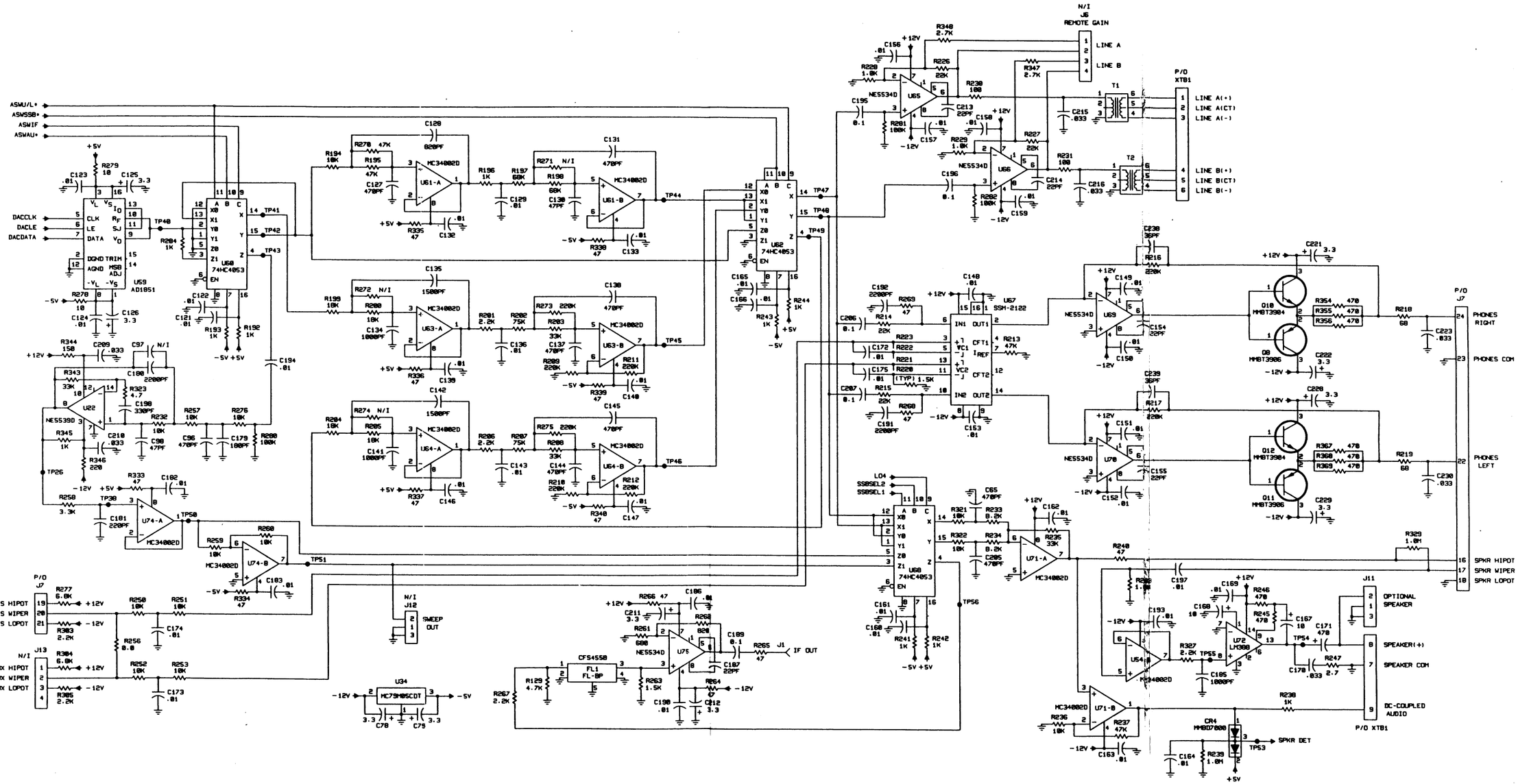


**Figure 9-1. Type 797012-1, Digital Control Assembly (A2), Schematic Diagram 581283 (Sheet 4 of 4) (H)**

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   A) RESISTANCE IS IN OHMS, ±5%, 1/10W.
   B) CAPACITANCE IS IN μF.
   C) INDUCTANCE IS IN μH.
2. PADDLE-STRIP 'E1' HAS A PLUG LABELED 'P1' (NOT SHOWN) WITH IDENTICAL PINS.
3. -3 AND -4 ARE CONFORMAL COATED VERSIONS OF -1 AND -2, RESPECTIVELY.

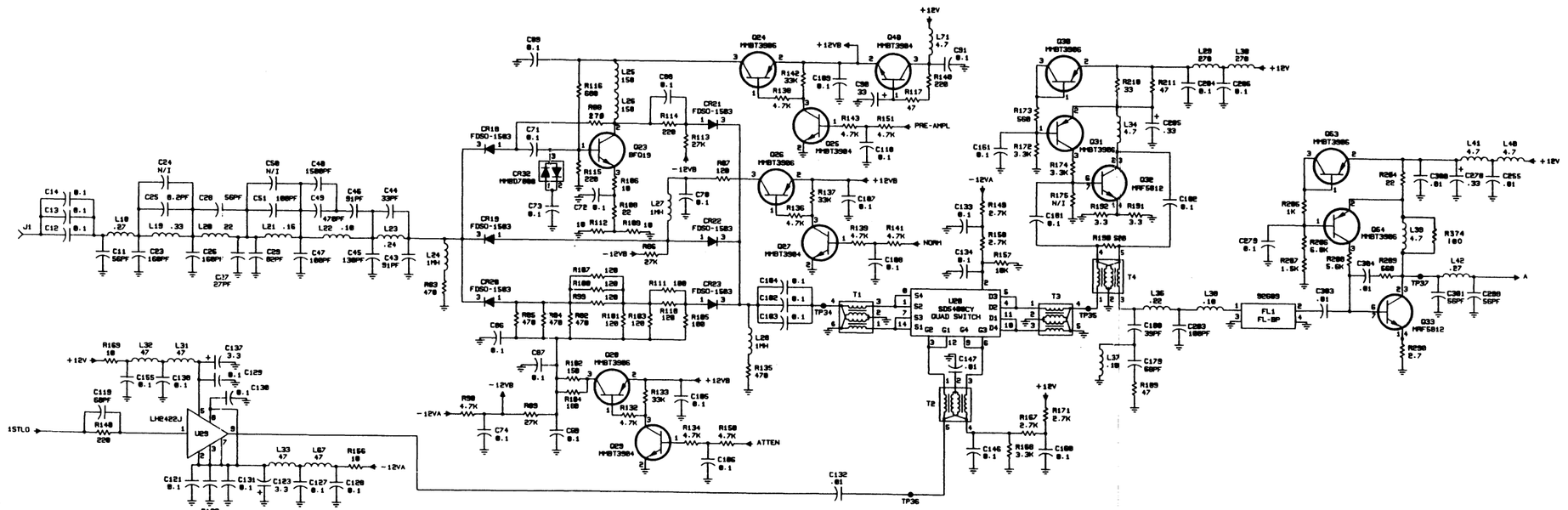


Figure 9-2. Type 797006-1, RF Tuner Assembly (A3), Schematic Diagram 581274 (Sheet 1 of 3) (J)

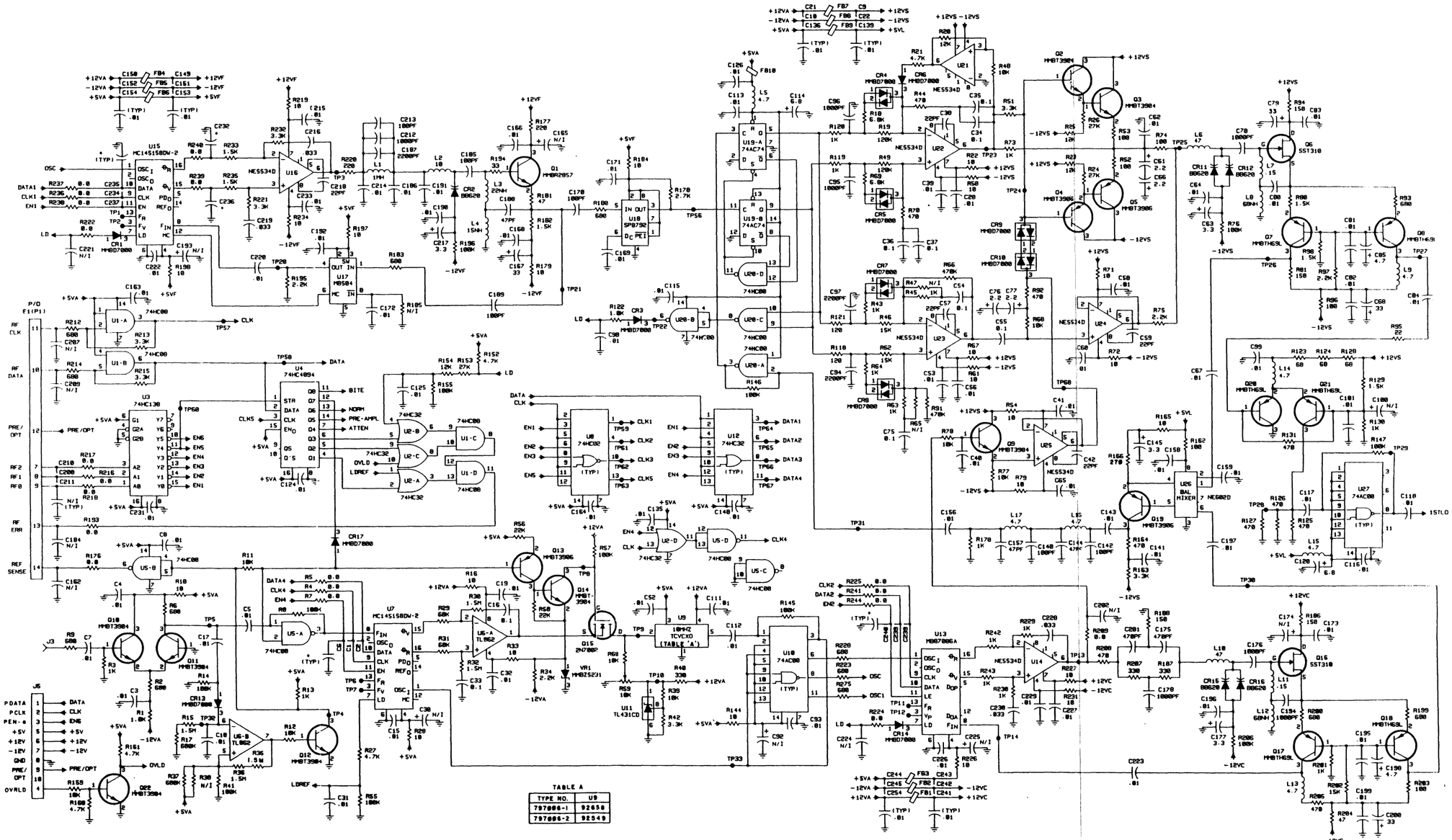


Figure 9-2. Type 797006-1, RF Tuner Assembly (A3), Schematic Diagram 581274 (Sheet 2 of 3) (J)

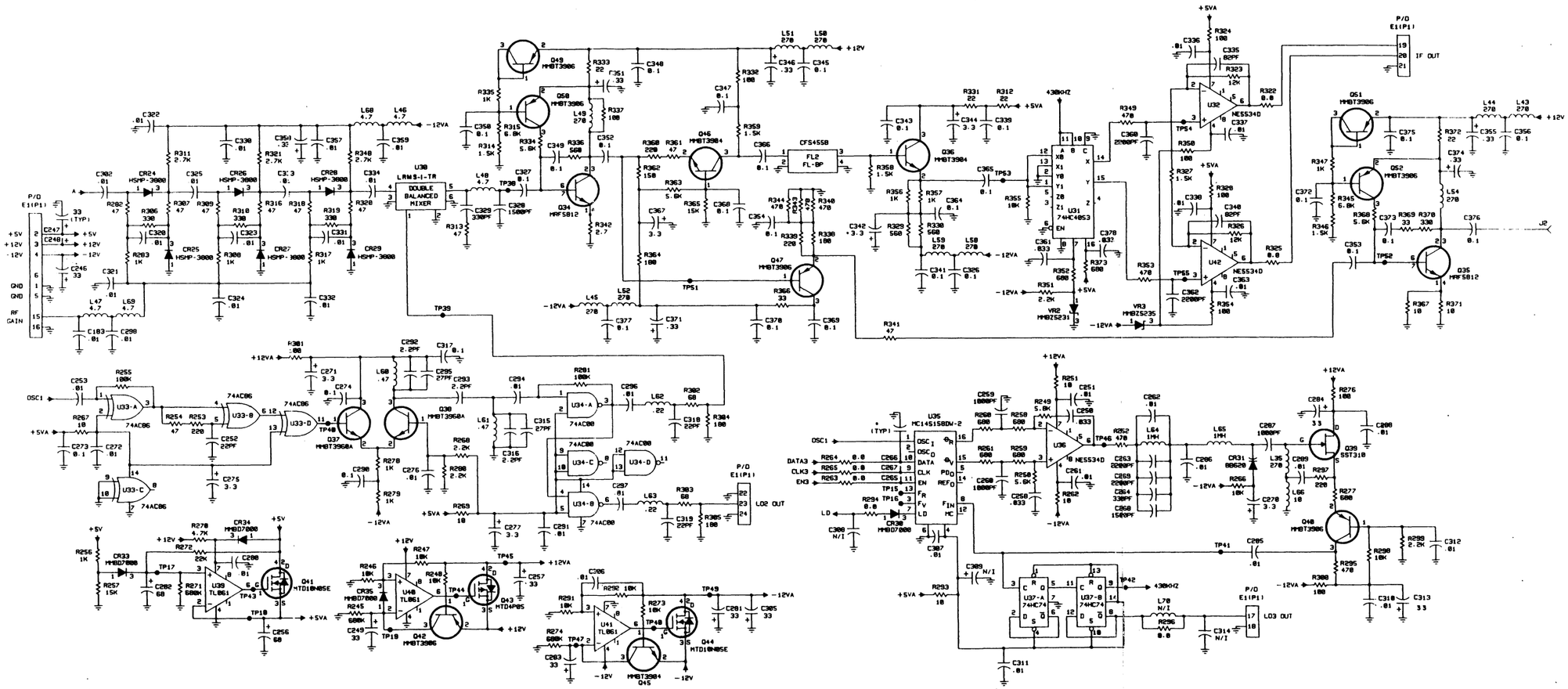


**Figure 9-2.** Type 797006-1, RF Tuner Assembly (A3), Schematic Diagram 581274 (Sheet 3 of 3) (J)

TABLE A

| APPLICATION | A1 | A2 | A3 | PS1 |
|---|---|---|---|---|
| WJ-8712 | 383876-1 | 797812-1 | 797806-1 | 841784 |
| 8711/REF | 383876-1 | 797812-1 | 797806-2 | 841784 |
| 8712/ENV | 383876-2 | 797812-2 | 797806-3 | 841792 |
| 8712/REFENV | 383876-2 | 797812-2 | 797806-4 | 841792 |

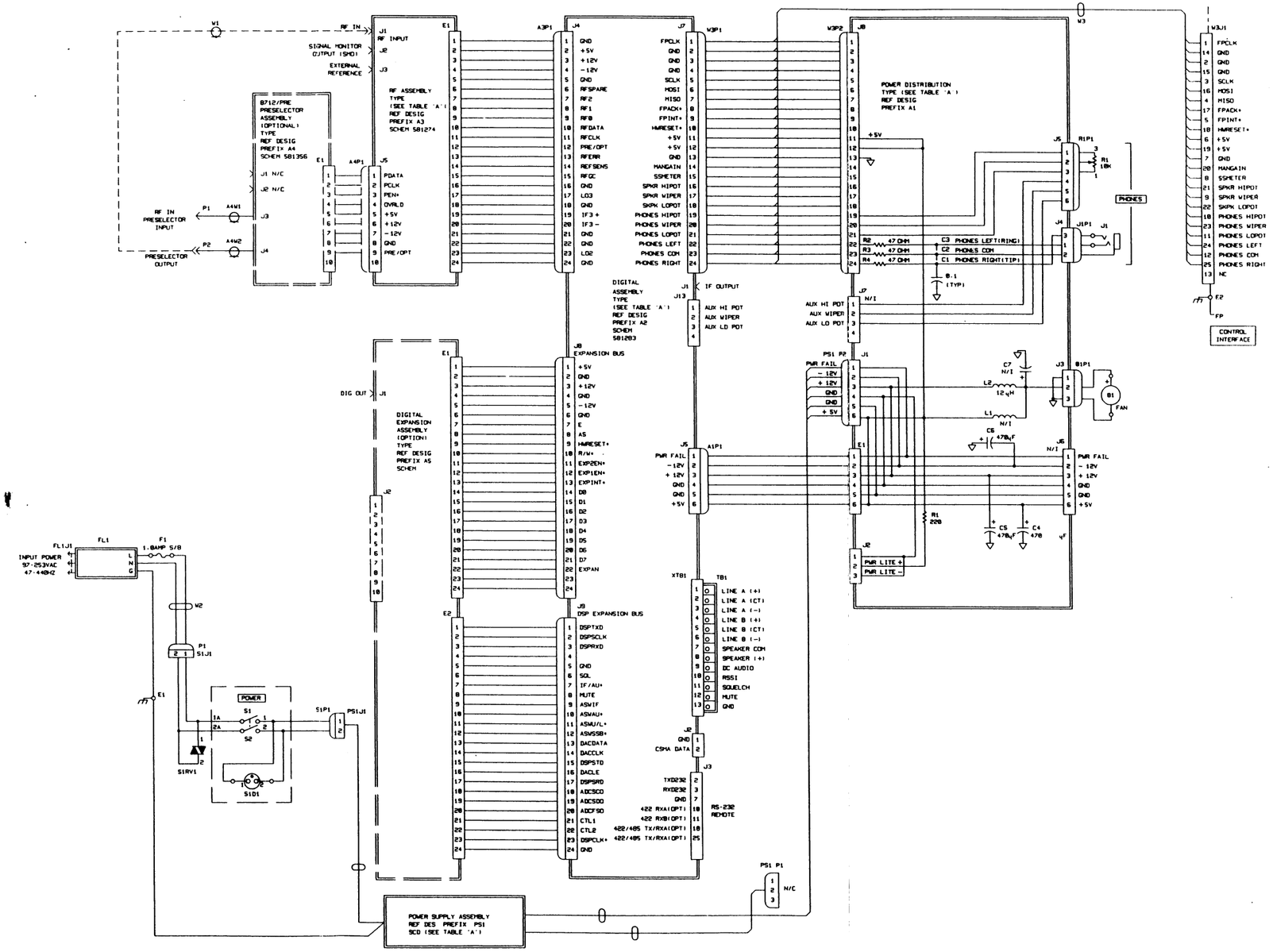


**Figure 9-3.** Type WJ-8712 Digital HF Receiver, Main Chassis Schematic Diagram 581424 (C)

# APPENDIX A

## TYPE WJ-871Y/REF REFERENCE GENERATOR OPTION



WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878-1794

September 1992

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### APPENDIX A

### TYPE WJ-871Y/REF REFERENCE GENERATOR OPTION



### LIST OF TABLES

# TYPE WJ-871Y/REF REFERENCE GENERATOR OPTION

## REVISION RECORD

| Revision | Description | Date |
|---|---|---|
| A | Initial Printing. | 9/92 |

# APPENDIX A

## TYPE WJ-871Y/REF REFERENCE GENERATOR OPTION

# APPENDIX A

# TYPE WJ-871Y/REFERENCE GENERATOR OPTION

## A.1 ELECTRICAL CHARACTERISTICS

When installed in either the WJ-8711 Digital HF Receiver or the WJ-8712 Digital HF Receiver, the WJ-871Y/REF Reference Generator option provides improved frequency stability (better than 0.1 ppm) over the standard WJ-8711 or WJ-8712 internal reference generator (better than 0.7 ppm). **Table A-1** lists the WJ-871Y/REF specifications.

**Table A-1. WJ-871Y/REF Reference Generator Option Specifications**

| | |
|---|---|
| Internal Frequency Stability ..... | Better than 0.1 ppm (0-50°C) |

## A.2 MECHANICAL CHARACTERISTICS

Receivers (either WJ-8711s or WJ-8712s) equipped with the WJ-871Y/REF Reference Generator option are mechanically identical to the standard receivers. In receivers equipped with the WJ-871Y/REF option, the type 797006-2 RF assembly replaces the standard type 797006-1 RF assembly. The WJ-871Y/REF option RF assembly uses an improved 10 MHz temperature-compensated voltage-controlled crystal oscillator (TCVCXO), located at A3U9.

## A.3 INSTALLATION

The WJ-871Y/REF Reference Generator option is installed in the Receiver (either WJ-8711 or WJ-8712) at the factory when ordered with the receiver.

## A.4 OPERATION

Once installed, WJ-871Y/REF option operates automatically. The improved reference generator functions just as the standard reference generator functions, only with greater stability. Either the internal 10 MHz reference frequency, or a user-supplied external 1, 2, 5, or 10 MHz reference frequency may be used. Refer to the base manual for information on selecting reference frequencies.

# APPENDIX B

## TYPE WJ-8712/PRE

## SUBOCTAVE PRESELECTOR OPTION



WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878-1794

December 1992

## PROPRIETARY STATEMENT

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## TYPE WJ-8712/PRE SUBOCTAVE PRESELECTOR OPTION



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# TYPE WJ-8712/PRE SUBOCTAVE PRESELECTOR OPTION

## REVISION RECORD

| Revision | Description | Date |
|---|---|---|
| A | Initial Printing. | 9/92 |
| B | Specification Update. Correction of Dimensions. | 12/92 |

# APPENDIX B

## TYPE WJ-8712/PRE SUBOCTAVE PRESELECTOR OPTION

## B.6 INSTALLATION

The WJ-8712/PRE Suboctave Preselector option is installed in the WJ-8712 Digital HF Receiver at the factory when ordered with the receiver.

### B.6.1 CONNECTOR SIGNALS

All WJ-8712/PRE option external connectors are located on the rear panel of the WJ-8712. **Table B-3** lists these connectors and provides a brief description of each.

**Table B-3. List of WJ-8712/PRE Option External Connectors**

| Connector | Reference Designation | Function |
|---|---|---|
| Preselector RF Input | A4J3 | BNC female. RF input from antenna. |
| Preselector RF Output | A4J4 | BNC female. Preselected RF output for use by the WJ-8712 RF IN connector (A3J1). |

Connector A4P1 contains all the power and control signals necessary for WJ-8712/PRE option operation. **Table B-4** lists the pins, signal names, signal functions, and the signal directions for connector A4P1.

**Table B-4. List of WJ-8712/PRE Option A4P1 Connector Signals**

| Pin | Signal | Function | Direction |
|---|---|---|---|
| 1 | PDAT | Preselector Selection Data | Input |
| 2 | PCLK | Preselector Clock | Input |
| 3 | PEN-# | Preselector Enable Strobe | Input |
| 4 | OVRLD | RF Overload | Output |
| 5 | +5 Vdc | +5 Vdc Supply | Input |
| 6 | +12 Vdc | +12 Vdc Supply | Input |
| 7 | -12 Vdc | -12 Vdc Supply | Input |
| 8 | GND | Ground | Input |
| 9 | PRE/OPT | Preselector Identification | Output |
| 10 | NOT USED | | |

## B.7 OPERATION

The WJ-8712 digital control automatically detects and operates the WJ-8712/PRE Suboctave Preselector option.

### B.7.1 PRESELECTOR OVERLOAD

During operations, the preselector continually checks its input for an overload condition. An overload-condition exists when the power at the preselector RF Input (A4J3) is greater than one watt.

During the overload, the overload-sensing circuit automatically protects the preselector by removing the applied RF signal from the preselector input. Accordingly, during the overload, the preselector significantly attenuates the RF signal to the receiver. A preselector overload condition also sets bit 13 of the Device Dependent Error register. Refer to the base manual for more information on the Device Dependent Error register. The set bit is utilized to request a reset via the remote controller.

## B.8 REPLACEMENT PARTS LIST

### B.8.1 UNIT NUMBERING METHOD

The method of numbering used throughout the unit is assigning reference designations (electrical symbol numbers) to identify: assemblies, subassemblies, modules within a subassembly, and discrete components. An example of the unit numbering method used is as follows:

| Subassembly Designation A1 | R1 Class and No. of Item |
|---|---|
| Identify from right to left as: | First (1) resistor (R) of first (1) subassembly (A) |

On the main chassis schematic, components which are an integral part of the main chassis have no subassembly designations.

### B.8.2 REFERENCE DESIGNATION PREFIX

The use of partial reference designations are used on the equipment and on the manual illustrations. This partial reference designation consists of the component type letter(s) and the identifying component number. The complete reference designation may be obtained by placing the proper prefix before the partial reference designation. Reference designation prefixes are included on the drawings and illustrations in the figure titles (in parenthesis).

### B.8.3 LIST OF MANUFACTURERS

| Mfr. Code | Name and Address | Mfr. Code | Name and Address |
|---|---|---|---|
| 04713 | Motorola Incorporated<br>5005 East McDowell Road<br>Phoenix, AZ 85008 | 17540 | Alpha Industries Incorporated<br>20 Sylvan Road<br>Woburn, MA 01801 |
| 06090 | Raychem Corporation<br>300 Constitution Drive<br>Menlo Park, CA 94025-1111 | 27014 | National Semi-Conductor, Corp.<br>2950 San Ysidro Way<br>Santa Clara, CA 95051 |
| 14632 | Watkins-Johnson Company<br>700 Quince Orchard Road<br>Gaithersburg, MD 20878 | 55322 | Samtec Incorporated<br>810 Progress Boulevard<br>P.O. Box 1147<br>New Albany, IN 47150 |

| Mfr. Code | Name and Address |
|---|---|
| 71482 | C.P. Clare Company<br>3101 Pratt Boulevard<br>Chicago, IL 60645 |
| 99800 | Delevan Electronics<br>270 Quaker Road<br>East Aurora, NY 14052-2114 |

## B.9 PARTS LIST

The following parts lists contain all the electrical components used in the unit, along with mechanical parts which may be subject to unusual wear or damage. When ordering replacement parts from the Watkins-Johnson Company, specify the unit type, the serial number, and the option configuration. Also include the reference designation and the description of each item ordered. The list of manufacturers, provided in **paragraph B.10**, and the manufacturer's part number, provided in **paragraph B.12**, are supplied as a guide to aid the user of the equipment while in the field. The parts listed may not necessarily be identical with the parts installed in the unit. The parts listed in **paragraph B.12** will provide for satisfactory unit operation.

Replacement parts may be obtained from any manufacturer provided that the physical characteristics and electrical parameters of the replacement item are compatible with the original part. In the case where components are defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

**NOTE**

As improved semiconductors become available, it is the policy of Watkins-Johnson to incorporate them in proprietary products. For this reason some transistors, diodes and integrated circuits installed in the equipment may not agree with those specified in the parts lists and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.

## B.10 TYPE WJ-8712/PRE PRESELECTOR ASSEMBLY (A4) OPTION

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| | Revision A | | | | |
| A4 | Preselector Assembly | 1 | 797033-2 | 14632 | |

B.10.1 **TYPE 797033-2 PRESELECTOR ASSEMBLY** REF DESIG PREFIX **A4A1**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| | Revision A | | | | |
| A1 | Preselector PC Assembly | 1 | 482202-2 | 14632 | |

B.10.1.1 **Type 482202-2 Preselector Assembly** REF DESIG PREFIX **A4A1A1**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| | Revision B1 | | | | |
| C1 | Capacitor, Ceramic: .047 µF, 10%, 50 V | 41 | 841415-023 | 14632 | |
| C2 | Capacitor, Tantalum: 10 µF, 20%, 35 V | 3 | 841293-17 | 14632 | |
| C3 Thru C6 | Not Used | | | | |
| C7 | Capacitor, Tantalum: 68 µF, 20%, 6.3 V | 2 | 841293-24 | 14632 | |
| C8 | Not Used | | | | |
| C9 | Not Used | | | | |
| C10 | Capacitor, Ceramic: 51 pF, 2%, 50 V NPO | 2 | 841416-042 | 14632 | |
| C11 | Not Used | | | | |
| C12 | Not Used | | | | |
| C13 | Capacitor, Ceramic: 100 pF, 2%, 50 V NPO | 10 | 841416-049 | 14632 | |
| C14 | Capacitor, Ceramic: 6.2 pF, ±.25 pF, 50 V | 1 | 841416-020 | 14632 | |
| C15 | Not Used | | | | |
| C16 | Not Used | | | | |
| C17 | Same as C10 | | | | |
| C18 Thru C20 | Not Used | | | | |
| C21 | Same as C1 | | | | |
| C22 | Capacitor, Ceramic: 33 pF, ±2%, 50 V NPO | 6 | 841416-037 | 14632 | |
| C23 | Capacitor, Ceramic: 6.8 pF, ±.25 pF, 50 V NPO | 7 | 841416-021 | 14632 | |
| C24 | Capacitor, Ceramic: 12 pF, 2%, 50 V NPO | 5 | 841416-027 | 14632 | |
| C25 | Same as C23 | | | | |
| C26 | Capacitor, Ceramic: 22 pF, 2%, 50 V NPO | 5 | 841416-033 | 14632 | |
| C27 | Same as C1 | | | | |
| C28 | Capacitor, Ceramic: 3.3 pF, ±.1 pF, 50 V NPO | 1 | 841416-013 | 14632 | |
| C29 | Same as C24 | | | | |
| C30 | Capacitor, Ceramic: 4.7 pF, ±.1 pF, 50 V NPO | 1 | 841416-017 | 14632 | |
| C31 | Not Used | | | | |
| C32 | Same as C22 | | | | |
| C33 | Capacitor, Tantalum: 6.8 µF, 20%, 6.3 V | 10 | 841293-14 | 14632 | |
| C34 | Not Used | | | | |
| C35 | Not Used | | | | |
| C36 | Same as C1 | | | | |
| C37 | Capacitor, Ceramic: 39 pF, 2%, 50 V NPO | 4 | 841416-039 | 14632 | |
| C38 | Capacitor, Ceramic: 8.2 pF, ±.25 pF, 50 V | 3 | 841416-023 | 14632 | |
| C39 | Same as C1 | | | | |
| C40 | Capacitor, Ceramic: 56 pF, 2%, 50 V NPO | 5 | 841416-043 | 14632 | |
| C41 | Same as C23 | | | | |

REF DESIG PREFIX A4A1A1

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C83 | Same as C79 | | | | |
| C84 | Same as C78 | | | | |
| C85 | Same as C44 | | | | |
| C86 | Same as C33 | | | | |
| C87 | Same as C76 | | | | |
| C88 | Same as C74 | | | | |
| C89 | Same as C13 | | | | |
| C90 | Same as C1 | | | | |
| C91 | Same as C76 | | | | |
| C92 | Same as C22 | | | | |
| C93 | Same as C1 | | | | |
| C94 | Capacitor, Ceramic: 220 pF, 2%, 50 V NPO | 6 | 841416-057 | 14632 | |
| C95 | Same as C79 | | | | |
| C96 | Capacitor, Ceramic: 330 pF, 2%, 50 V NPO | 4 | 841416-061 | 14632 | |
| C97 | Capacitor, Ceramic: 82 pF, ±2%, 50 V NPO | 5 | 841416-047 | 14632 | |
| C98 | Same as C97 | | | | |
| C99 | Same as C1 | | | | |
| C100 | Same as C74 | | | | |
| C101 | Same as C96 | | | | |
| C102 | Same as C97 | | | | |
| C103 | Same as C79 | | | | |
| C104 | Same as C33 | | | | |
| C105 | Same as C94 | | | | |
| C106 | Same as C22 | | | | |
| C107 | Same as C76 | | | | |
| C108 | Same as C1 | | | | |
| C109 | Capacitor, Ceramic: 180 pF, 2%, 50 V NPO | 5 | 841416-055 | 14632 | |
| C110 | Same as C37 | | | | |
| C111 | Same as C1 | | | | |
| C112 | Same as C78 | | | | |
| C113 | Same as C62 | | | | |
| C114 | Capacitor, Ceramic: 470 pF, 2%, 50 V NPO | 6 | 841416-065 | 14632 | |
| C115 | Same as C62 | | | | |
| C116 | Same as C76 | | | | |
| C117 | Same as C44 | | | | |
| C118 | Same as C1 | | | | |
| C119 | Same as C33 | | | | |
| C120 | Same as C114 | | | | |
| C121 | Same as C62 | | | | |
| C122 | Same as C62 | | | | |

REF DESIG PREFIX A4A1A1

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C123 | Same as C78 | | | | |
| C124 | Same as C37 | | | | |
| C125 | Same as C76 | | | | |
| C126 | Same as C1 | | | | |
| C127 | Same as C94 | | | | |
| C128 | Same as C1 | | | | |
| C129 | Same as C22 | | | | |
| C130 | Same as C96 | | | | |
| C131 | Same as C97 | | | | |
| C132 | Same as C1 | | | | |
| C133 | Capacitor, Ceramic: 680 pF, ±2%, 50 V NPO | 4 | 841416-069 | 14632 | |
| C134 | Same as C79 | | | | |
| C135 | Same as C78 | | | | |
| C136 | Same as C79 | | | | |
| C137 | Same as C133 | | | | |
| C138 | Same as C79 | | | | |
| C139 | Same as C97 | | | | |
| C140 | Same as C33 | | | | |
| C141 | Same as C96 | | | | |
| C142 | Same as C22 | | | | |
| C143 | Same as C94 | | | | |
| C144 | Same as C1 | | | | |
| C145 | Same as C78 | | | | |
| C146 | Same as C58 | | | | |
| C147 | Same as C1 | | | | |
| C148 | Same as C114 | | | | |
| C149 | Same as C13 | | | | |
| C150 | Same as C1 | | | | |
| C151 | Same as C1 | | | | |
| C152 | Not Used | | | | |
| C153 | Not Used | | | | |
| C154 | Capacitor, Ceramic: 560 pF, 2%, 50 V NPO | 1 | 841416-067 | 14632 | |
| C155 | Capacitor, Ceramic: 1000 pF, 2%, TOL, 50 V NPO | 1 | 841416-073 | 14632 | |
| C156 | Same as C13 | | | | |
| C157 | Same as C1 | | | | |
| C158 | Same as C7 | | | | |
| C159 | Same as C1 | | | | |
| C160 | Capacitor, Ceramic: 820 pF, ±2%, 50 V NPO | 4 | 841416-071 | 14632 | |
| C161 | Capacitor, Ceramic: 120 pF, 2%, 50 V NPO | 2 | 841416-051 | 14632 | |
| C162 | Capacitor, Ceramic: 390 pF, 2%, 50 V NPO | 1 | 841416-063 | 14632 | |
| C163 | Same as C40 | | | | |
| C164 | Same as C33 | | | | |

REF DESIG PREFIX A4A1A1

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C165 | Same as C160 | | | | |
| C166 | Same as C161 | | | | |
| C167 | Same as C13 | | | | |
| C168 | Same as C114 | | | | |
| C169 | Same as C58 | | | | |
| C170 | Same as C78 | | | | |
| C171 | Same as C1 | | | | |
| C172 | Same as C40 | | | | |
| C173 | Same as C114 | | | | |
| C174 | Same as C1 | | | | |
| C175 | Same as C109 | | | | |
| C176 | Same as C133 | | | | |
| C177 | Same as C109 | | | | |
| C178 | Capacitor, Ceramic: 1200 pF, 2%, 50 V NPO | 4 | 841416-075 | 14632 | |
| C179 | Same as C79 | | | | |
| C180 | Same as C1 | | | | |
| C181 | Same as C109 | | | | |
| C182 | Same as C178 | | | | |
| C183 | Same as C33 | | | | |
| C184 | Same as C109 | | | | |
| C185 | Same as C133 | | | | |
| C186 | Same as C114 | | | | |
| C187 | Same as C40 | | | | |
| C188 | Same as C94 | | | | |
| C189 | Same as C1 | | | | |
| C190 | Capacitor, Ceramic: .15 µF, 10%, 50 V | 1 | 841415-020 | 14632 | |
| C191 | Same as C160 | | | | |
| C192 | Capacitor, Ceramic: 1500 pF, 2%, 50 V NPO | 4 | 841416-077 | 14632 | |
| C193 | Same as C1 | | | | |
| C194 | Same as C178 | | | | |
| C195 | Same as C33 | | | | |
| C196 | Same as C178 | | | | |
| C197 | Same as C192 | | | | |
| C198 | Same as C94 | | | | |
| C199 | Same as C160 | | | | |
| C200 | Same as C1 | | | | |
| C201 | Capacitor, Ceramic: 2700 pF, 2%, ≥ 50 WVDC NPO | 2 | 841314-083 | 14632 | |
| C202 | Same as C201 | | | | |
| C203 | Not Used | | | | |
| C204 | Not Used | | | | |
| C205 | Same as C2 | | | | |
| C206 | Same as C192 | | | | |
| C207 | Capacitor, Ceramic: 4700 pF, 2%, ≥50 WVDC NPO | 2 | 841314-089 | 14632 | |
| C208 | Same as C192 | | | | |
| C209 | Same as C207 | | | | |
| C210 | Not Used | | | | |

REF DESIG PREFIX A4A1A1

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| C211 | Not Used | | | | |
| C212 | Same as C1 | | | | |
| C213 | Same as C1 | | | | |
| C214 | Not Used | | | | |
| C215 | Not Used | | | | |
| C216 | Same as C2 | | | | |
| C217 Thru C223 | Not Used | | | | |
| C224 | Same as C217 | | | | |
| C225 | Same as C1 | | | | |
| C226 | Capacitor, Tantalum: 4.7 µF, 20%, 10 V | 4 | 841293-12 | 14632 | |
| C227 | Same as C226 | | | | |
| C228 | Same as C1 | | | | |
| C229 | Same as C226 | | | | |
| C230 | Same as C226 | | | | |
| C231 | Same as C13 | | | | |
| C232 | Same as C13 | | | | |
| C233 | Same as C1 | | | | |
| C234 Thru C237 | Not Used | | | | |
| C238 Thru C240 | Same as C1 | | | | |
| CR1 | Not Used | | | | |
| CR2 | Diode, Dual Switching | 2 | MMBD7000LT1 | 04713 | |
| CR3 | Diode | 2 | MMBD1203-HIGH | 27014 | |
| CR4 | Same as CR3 | | | | |
| CR5 | Diode | 20 | SMP1300-99 | 17540 | |
| CR6 Thru CR24 | Same as CR5 | | | | |
| CR25 | Not Used | | | | |
| CR26 | Same as CR2 | | | | |
| CR27 | Not Used | | | | |
| CR28 | Not Used | | | | |
| CR29 | Diode, Pin | 2 | MA4P4001F | MAICO | |
| CR30 | Same as CR29 | | | | |
| E1 | Cable Assembly | 1 | IDMD-5-T-10-C-G | 55322 | |
| J1 | Not Used | | | | |
| J2 | Not Used | | | | |
| J3 | Termination, Coaxial | 2 | D-607-10 | 06090 | |
| J4 | Same as J3 | | | | |
| JW1 | Jumper: 1/2Ω | 5 | 841417 | 14632 | |
| JW2 Thru JW5 | Same as JW1 | | | | |

REF DESIG PREFIX **A4A1A1**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| K1 | Relay | 1 | SMJ1A05-S | 14632 | |
| L1 | Not Used | | | | |
| L2 | Inductor: 220 nH, ±5% | 2 | 841438-033 | 14632 | |
| L3 | Same as L2 | | | | |
| L4 | Inductor: 680 nH, ±5% | 9 | 841438-045 | 14632 | |
| L5 | Same as L4 | | | | |
| L6 | Same as L4 | | | | |
| L7 | Inductor: 330 µH, 5% | 20 | 841444-061 | 14632 | |
| L8 | Same as L7 | | | | |
| L9 | Same as L7 | | | | |
| L10 Thru L12 | Same as L4 | | | | |
| L13 | Same as L7 | | | | |
| L14 | Same as L7 | | | | |
| L15 | Inductor: 560 nH, ±5% | 3 | 841438-043 | 14632 | |
| L16 | Same as L15 | | | | |
| L17 | Same as L15 | | | | |
| L18 | Same as L7 | | | | |
| L19 | Same as L7 | | | | |
| L20 Thru L22 | Same as L4 | | | | |
| L23 | Same as L7 | | | | |
| L24 | Same as L7 | | | | |
| L25 | Inductor: 1.0 µH, 5% | 3 | 841444-001 | 14632 | |
| L26 | Same as L25 | | | | |
| L27 | Same as L25 | | | | |
| L28 | Same as L7 | | | | |
| L29 | Same as L7 | | | | |
| L30 | Inductor: 1.5 µH, 5% | 3 | 841444-05 | 14632 | |
| L31 | Same as L30 | | | | |
| L32 | Same as L30 | | | | |
| L33 | Same as L7 | | | | |
| L34 | Same as L7 | | | | |
| L35 | Inductor: 2.2 µH, 5% | 3 | 841444-009 | 14632 | |
| L36 | Same as L35 | | | | |
| L37 | Same as L35 | | | | |
| L38 | Same as L7 | | | | |
| L39 | Same as L7 | | | | |
| L40 | Inductor: 3.3 µH, 5% | 3 | 841444-013 | 14632 | |
| L41 | Same as L40 | | | | |
| L42 | Same as L40 | | | | |
| L43 | Same as L7 | | | | |
| L44 | Same as L7 | | | | |
| L45 | Inductor: 4.7 µH, 5% | 3 | 841444-017 | 14632 | |

REF DESIG PREFIX **A4A1A1**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| L46 | Same as L45 | | | | |
| L47 | Same as L45 | | | | |
| L48 | Same as L7 | | | | |
| L49 | Same as L7 | | | | |
| L50 | Inductor: 5600 nH, ±5% | 2 | 841438-067 | 14632 | |
| L51 | Inductor: 6800 nH, ±5% | 1 | 841438-069 | 14632 | |
| L52 | Same as L50 | | | | |
| L53 | Same as L7 | | | | |
| L54 | Inductor: 680 µH, 5% | 5 | 841444-069 | 14632 | |
| L55 | Same as L54 | | | | |
| L56 | Inductor: 12 µH | 2 | 1330-46 | 99800 | |
| L57 | Inductor | 1 | 1330-54 | 99800 | |
| L58 | Same as L56 | | | | |
| L59 | Same as L54 | | | | |
| L60 | Same as L54 | | | | |
| L61 | Inductor: 47 µH, 5% | 1 | 841444-041 | 14632 | |
| L62 Thru L65 | Not Used | | | | |
| L66 | Same as L54 | | | | |
| Q1 | Transistor | 2 | MMBT3904LT1 | 04713 | |
| Q2 | Same as Q1 | | | | |
| Q3 | Transistor | 11 | MMBT2907ALT1 | 04713 | |
| Q4 Thru Q13 | Same as Q3 | | | | |
| Q14 | Transistor | 1 | MTD10N05E | 04713 | |
| R1 | Resistor, Fixed: 3.9 kΩ, 5%, 1/10 W | 1 | 841414-087 | 14632 | |
| R2 | Resistor, Fixed: 1.0 kΩ, 5%, 1/10 W | 8 | 841414-073 | 14632 | |
| R3 | Resistor, Fixed: 10Ω, 5%, 1/10 W | 13 | 841414-097 | 14632 | |
| R4 | Same as R3 | | | | |
| R5 | Resistor, Fixed: 10Ω, 5%, 1/10 W | 23 | 841414-025 | 14632 | |
| R6 | Same as R5 | | | | |
| R7 | Same as R3 | | | | |
| R8 | Resistor, Fixed: 330Ω, 5%, 1/10 W | 15 | 841414-061 | 14632 | |
| R9 | Same as R5 | | | | |
| R10 | Same as R5 | | | | |
| R11 | Same as R3 | | | | |
| R12 | Same as R8 | | | | |
| R13 | Same as R5 | | | | |
| R14 | Same as R3 | | | | |
| R15 | Same as R5 | | | | |
| R16 | Same as R8 | | | | |

REF DESIG PREFIX **A4A1A1**

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM VENDOR |
|---|---|---|---|---|---|
| R17 | Same as R5 | | | | |
| R18 | Same as R3 | | | | |
| R19 | Same as R5 | | | | |
| R20 | Same as R8 | | | | |
| R21 | Same as R5 | | | | |
| R22 | Same as R3 | | | | |
| R23 | Same as R8 | | | | |
| R24 | Same as R5 | | | | |
| R25 | Same as R5 | | | | |
| R26 | Same as R3 | | | | |
| R27 | Same as R5 | | | | |
| R28 | Same as R8 | | | | |
| R29 | Same s R5 | | | | |
| R30 | Same as R3 | | | | |
| R31 | Same as R5 | | | | |
| R32 | Same as R8 | | | | |
| R33 | Same as R5 | | | | |
| R34 | Same as R3 | | | | |
| R35 | Same as R8 | | | | |
| R36 | Same as R5 | | | | |
| R37 | Same as R3 | | | | |
| R38 | Same as R5 | | | | |
| R39 | Same as R8 | | | | |
| R40 | Same as R5 | | | | |
| R41 | Same as R5 | | | | |
| R42 | Same as R3 | | | | |
| R43 | Same as R5 | | | | |
| R44 | Same as R8 | | | | |
| R45 | Not Used | | | | |
| R46 | Same as R2 | | | | |
| R47 | Same as R2 | | | | |
| R48 | Resistor, Fixed: 15 kΩ, 5%, 1/10 W | 1 | 841414-101 | 14632 | |
| R49 | Resistor, Fixed: 680 kΩ, 5%, 1/10 W | 1 | 841414-141 | 14632 | |
| R50 | Resistor, Fixed: 22 kΩ, 5%, 1/10 W | 1 | 841414-105 | 14632 | |
| R51 | Resistor, Fixed: 4.7 kΩ, 5%, 1/10 W | 1 | 841414-089 | 14632 | |
| R52 | Same as R5 | | | | |
| R53 | Same as R3 | | | | |
| R54 | Same as R5 | | | | |
| R55 | Same as R8 | | | | |
| R56 | Not Used | | | | |

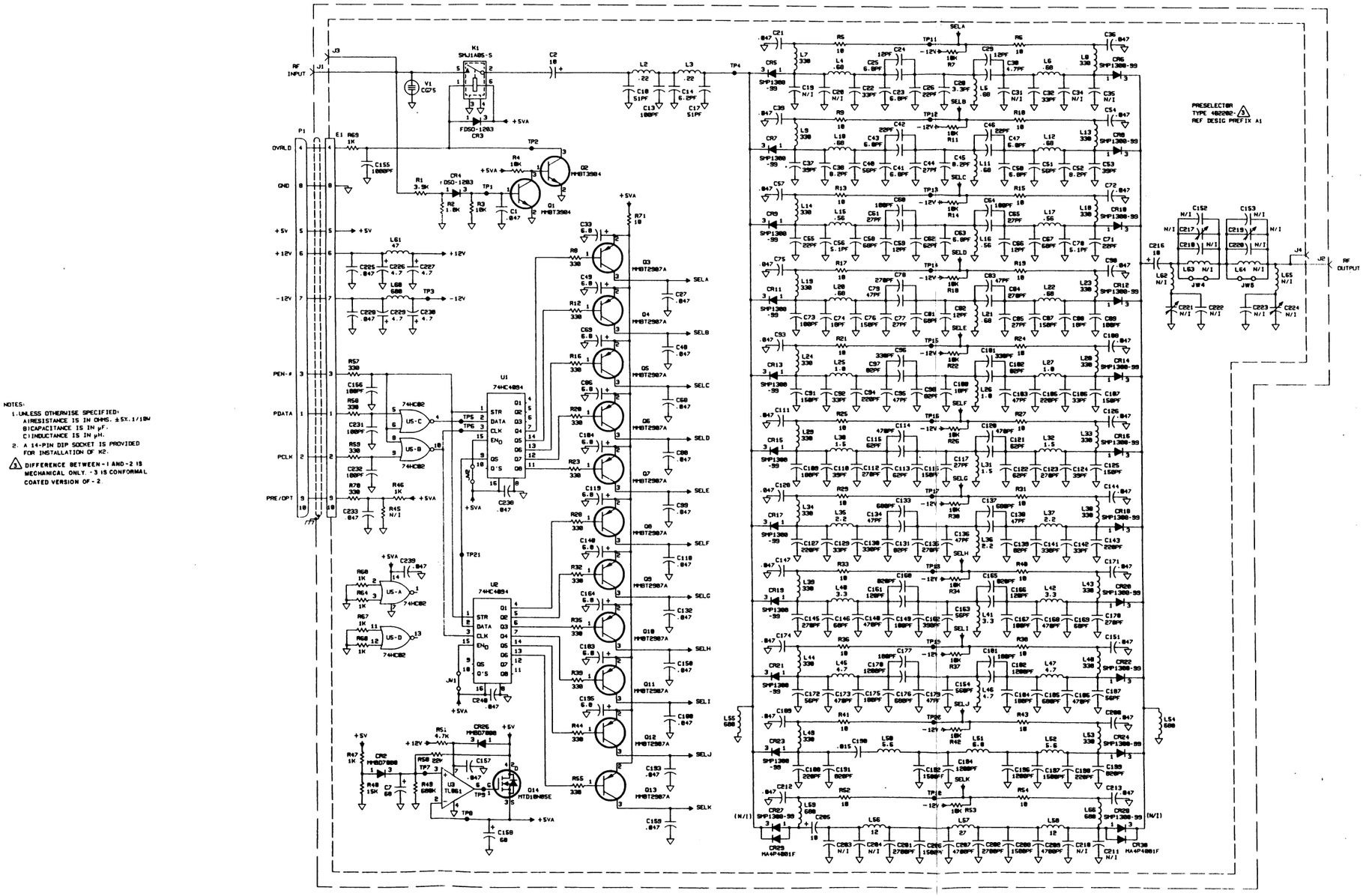


Figure B-1. Type 797033-2, Preselector Assembly (A4), Schematic Diagram 581356 (C)

# APPENDIX C

## WJ-8712/FP FRONT PANEL OPTION



WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878-1794

December 1992

## WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

## PROPRIETARY STATEMENT

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### APPENDIX C (Continued)



## LIST OF TABLES



## LIST OF ILLUSTRATIONS

## WJ-8712/FP FRONT PANEL OPTION

## REVISION RECORD

| Revision | Description | Date |
|---|---|---|
| A | Initial Issue. | 12/92 |

# APPENDIX C

## WJ-8712 TEST FIXTURE INSTRUCTIONS

# APPENDIX C

# TF-30387 FRONT PANEL INTERFACE INSTRUCTIONS

## C.1 INTRODUCTION

This appendix provides information related to the test operation of the WJ-8712 Digital HF Receiver using the front panel controls, indicators, and displays of a TF-30387 Front Panel Interface. **Paragraph C.2** provides details on the general use of each control, indicator, and display located on the front panel.

The WJ-8712 front panel **CONTROL INTERFACE** connector is used to cable connect the TF-30387 Front Panel Interface. In addition to a cable test fixture this setup is used in the following test procedure.

Before attempting to test the receiver, it is recommended that the operator become familiar with the capabilities of the front panel controls, indicators, and displays by reading the descriptions provided in **paragraph C.2.**

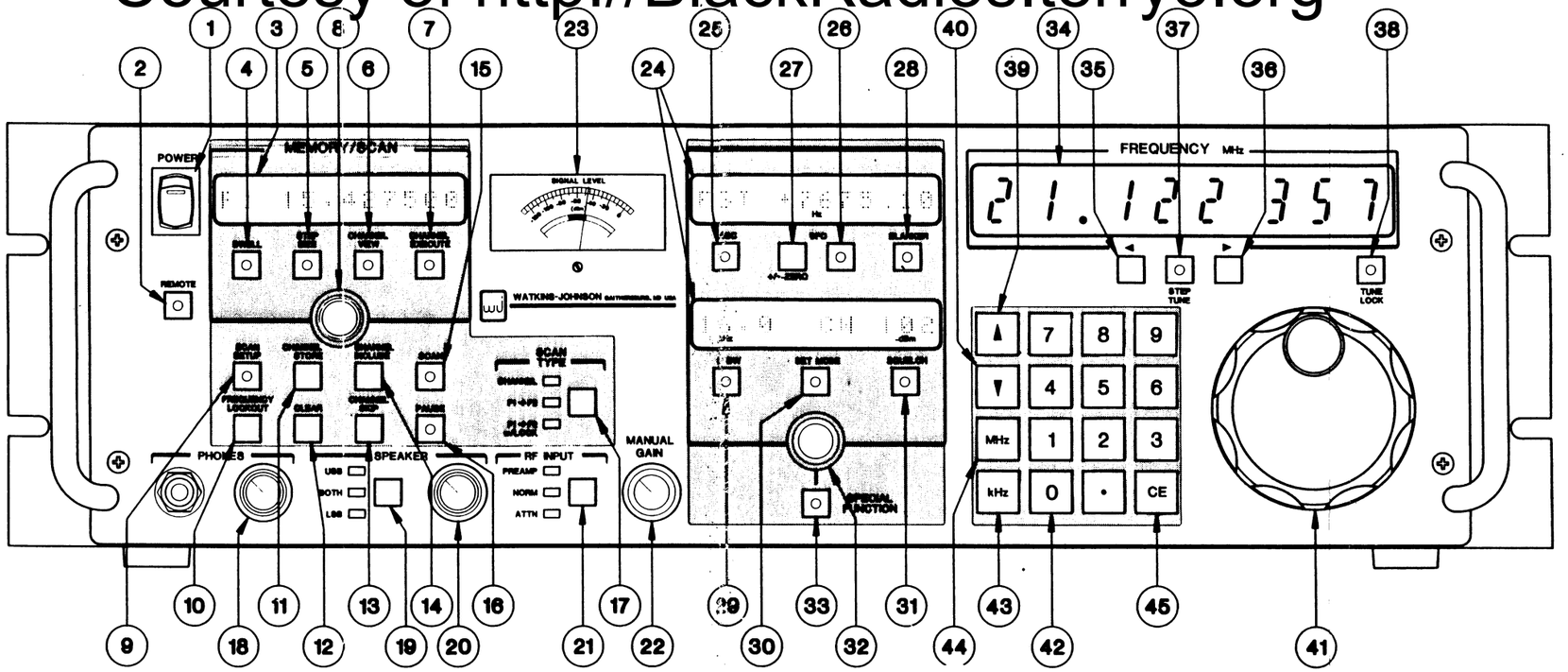
## C.2 DESCRIPTION OF CONTROLS, INDICATORS, AND DISPLAYS

The TF-30387 Front Panel Interface contains all of the controls, indicators, and displays that are used for local operation. **Figure C-1** shows their locations on the front panel.

Front panel controls consist of keys, volume control knobs, parameter adjust knobs, and a tuning wheel. Indicators consist of light emitting diodes (LED's) that are located in the center of some keys and LED's that are adjacent to keys. The front panel also provides a -120 to +10 dBm signal level meter. Displays consists of three 12-character, alphanumeric displays and one 8-character numeric display.

As shown in **Figure C-1,** three sections of the front panel have shaded backgrounds. These shaded areas are provided as an aid to the operator by grouping sets of keys within particular functional areas of receiver operations. For example, the shaded area on the far left of the front panel indicates that all keys and the display within that area are associated with Memory and Scan operations and is referred to as the Memory/Scan Section. The shaded area in the center of the front panel contains keys and displays that are associated with the auxiliary parameters of the receiver such as detection mode, IF bandwidth, squelch, etc. This area is referred to as the Auxiliary Parameter Section. The third area highlights the 16-key keypad.

The following paragraphs provide more details on the general use of each control, indicator, and display.




| Item | Para. Ref. | Function |
|---|---|---|
| 1 | C.2.42 | On and off are not used |
| 2 | C.2.41 | Places receiver in and out of Remote mode. LED lit when in Remote. |
| 3 | C.2.20 | Displays memory and Scan functions. |
| 4 | C.2.21 | Enables entry of dwell time. Activated when lit. |
| 5 | C.2.22 | Enables entry of step size for tuned frequency and scan. Activated when lit. |
| 6 | C.2.23 | Allows viewing of stored channel frequencies when lit. |
| 7 | C.2.24 | Sets receiver to parameters stored in the displayed memory channel. |
| 8 | C.2.34 | Adjusts displayed memory or scan parameters. |
| 9 | C.2.26 | Enables the entry of scan setups when lit. |
| 10 | C.2.27 | Store current receiver parameters into lockout memory. |
| 11 | C.2.28 | Stores current receiver parameters in the displayed memory channel |
| 12 | C.2.29 | Clears displayed lockout frequency or Memory/Scan display. Clears all lockout and memory channels when pressed 3 times. |

| Item | Para. Ref. | Function |
|---|---|---|
| 13 | C.2.31 | Sets displayed channel to "skip" status for scans. |
| 14 | C.2.30 | Sets displayed channel to "include" status for scans. |
| 15 | C.2.32 | Initiates scan mode. Scan mode active when lit. |
| 16 | C.2.33 | Pauses or resumes an active scan. Scan paused when lit. |
| 17 | C.2.23 | Selects the scan type. Selection indicated by lit LED. |
| 18 | C.2.35 | Adjusts headphones volume. |
| 19 | C.2.36 | Selects speaker audio for ISB mode. Selection indicated by lit LED. |
| 20 | C.2.37 | Adjusts speaker volume. |
| 21 | C.2.38 | Selects path for RF input. Selection indicated by LED. |
| 22 | C.2.39 | Adjusts gain in manual gain mode. |
| 23 | C.2.40 | Displays the signal strength of the current received signal. |
| 24 | C.2.10 | Displays auxiliary receiver parameters and special functions. |
| 25 | C.2.14 | Enables selection of gain control mode (Fast or Slow AGC, or MAN) when lit. |

| Item | Para. Ref. | Function |
|---|---|---|
| 26 | C.2.15 | Enables adjustment of BFO freq. when lit and in CW det. mode. |
| 27 | C.2.16 | Sets displayed BFO freq to positive, negative, or zero. |
| 28 | C.2.17 | Allows adjustment of noise blanking time when lit. |
| 29 | C.2.11 | Allows selection of IF bandwidth when lit. |
| 30 | C.2.12 | Allows selection of detection mode when lit. |
| 31 | C.2.13 | Allows adjustment of squelch level when lit. |
| 32 | C.2.19 | Adjusts enabled auxiliary parameter or special function. |
| 33 | C.2.18 | Accesses passband tuning, remote configurations, and BITE functions. |
| 34 | C.2.1 | Displays current tuned frequency. |
| 35 | C.2.3 | Moves the frequency display cursor left. |
| 36 | C.2.3 | Moves the frequency display cursor right. |
| 37 | C.2.9 | Selects the step tuning mode. Mode is activated when lit. |

| Item | Para. Ref. | Function |
|---|---|---|
| 38 | C.2.2 | Disables the tuning wheel and up and down arrow keys. Controls disabled when lit. |
| 39 | C.2.5 | Increases tuned frequency by incrementing the highlighted digit or by the selected step size (in Step Tune mode). |
| 40 | C.2.5 | Decreases tuned frequency by decrementing the highlighted digit or by the selected step size (in Step Tune mode). |
| 41 | C.2.4 | Increases or decreases tuned frequency by increasing or decreasing the highlighted digit or by the selected step size (Step Tune mode). |
| 42 | C.2.6 | These keys (0 though 9 and decimal point) allow for entering various numeric parameters. |
| 43 | C.2.7 | Terminates a numeric entry of tuned frequency, indicating kilohertz. |
| 44 | C.2.7 | Terminates a numeric entry of tuned frequency, indicating megahertz. |
| 45 | C.2.8 | Clears an in-progress, unterminated numeric entry. |

Figure C-1. Front Panel Controls, Indicators, and Displays

### C.2.3 THE ← (LEFT) AND → (RIGHT) ARROW KEYS

The ← (left) and → (right) arrow keys are located just below the tuned frequency display. The keys have no LED's and are used to move the cursor position in the tuned frequency display. The following are general guidelines to remember when using these keys.

- Pressing either ← or → while the TUNE LOCK LED is lit causes it to extinguish and the tune lock function to be disabled. The cursor in the tuned frequency display appears in the position to which it was previously set.
- Pressing either ← or → while the STEP TUNE LED is lit causes it to extinguish and the Step Tune mode to be exited. The cursor in the tuned frequency display appears in the position to which it was previously set.
- The ← and → keys are not functional while the receiver is actively scanning (i.e. the SCAN key LED is lit and the PAUSE key LED is not lit) or if a numeric entry is in progress and not terminated.
- The ← and → keys move the highlighted digit of the tuned frequency display left and right, respectively, with the following restrictions:
  1) the → key has no effect when the highlighted digit is in the 1-Hz position (far right) of the tuned frequency display,
  2) the ← key has no effect when the highlighted digit is in the 10-MHz position (far left) of the tuned frequency display, and
  3) if no digit is present in the 10-MHz position (the tuned frequency is 9.999999 MHz or less) moving the cursor to this position with the ← key causes a zero (0) to be displayed there.

### C.2.4 THE TUNING WHEEL

The tuning wheel is a 2-1/2 inch diameter knob located in the lower right-hand corner of the front panel. The only function of the tuning wheel is to change the receiver's tuned frequency. The following are general guidelines to remember when using the tuning wheel.

- Rotating the tuning wheel clockwise increases and rotating it counterclockwise decreases the receiver's tuned frequency in increments corresponding to the cursor highlighted digit in the tuned frequency display.

- When the Step Tune mode is enabled (STEP TUNE key LED is lit), rotating the tuning wheel clockwise increases and rotating it counterclockwise decrease the receiver's tuned frequency in units equal to the current setting of the Memory/Scan step size (see **paragraph C.2.22**).

- The tuning wheel is not functional while the TUNE LOCK key LED is lit, while the receiver is actively scanning or if a numeric entry is in progress and not terminated.

- The receiver's tuned frequency cannot be incremented or decremented beyond the tuning range of the receiver (0.000000 to 30.000000). The display also does not "wrap around" to the other limit (i.e., it will not go from 0.000000 to 30.000000 when decrementing and will not go from 30.000000 to 0.000000 when incrementing).

### C.2.5 THE ↑ (UP) AND ↓ (DOWN) ARROW KEYS

The ↑ (up) and ↓ (down) arrow keys are part of the 16-key keypad located below the tuned frequency display. The function of these keys is to change the receiver's tuned frequency. The following are general guidelines to remember when using these keys.

- Each press of the ↑ or ↓ keys increase or decrease, respectively, the receiver's tuned frequency in increments corresponding to the cursor highlighted digit in the tuned frequency display.

- When the Step Tune mode is enabled (STEP TUNE key LED is lit), pressing the ↑ key increases and pressing the ↓ key decreases the receiver's tuned frequency in units equal to the current setting of the Memory/Scan step size (see **paragraph C.2.22**).

- The ↑ and ↓ keys are not functional while the TUNE LOCK key LED is lit, while the receiver is actively scanning or if a numeric entry is in progress and not terminated.

- The receiver's tuned frequency cannot be increased or decreased beyond the tuning range of the receiver (0.000000 to 30.000000). The display also does not "wrap around" to the other limit (i.e. it will not go from 0.000000 to 30.000000 when decrementing and will not go from 30.000000 to 0.000000 when incrementing).

### C.2.6 THE NUMERIC ENTRY KEYS (0-9 AND DECIMAL POINT)

The numeric entry keys are provided to allow the operator to enter numbers for various receiver parameters instead of using edit knobs or the tuning wheel. A numeric entry can be performed as long as the receiver is not actively scanning. The following are receiver parameters that can be entered with the numeric entry keys:

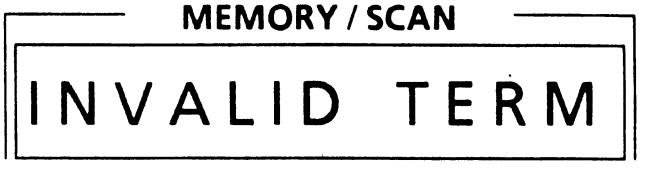
- Receiver Tuned Frequency (**paragraph C.5.1**),
- Beat Frequency Oscillator Frequency (**paragraph C.5.7**),
- Noise Blanker Frequency (**paragraph C.5.9**),
- Squelch Level (**paragraph C.5.4**),
- Scan Dwell Time (**paragraph C.8.1**),
- Scan Lockout Frequency (**paragraph C.8.2.3**),
- Scan Setups (**paragraph C.8.2**),
- Step Size (**paragraphs C.5.1, C.8.2**), and
- Memory Channel View, Channel Store, Channel Skip, Channel Include (**paragraphs C.6, C.7, C.8**).

Refer to the appropriate paragraphs listed above for the exact use and limitations when using these keys for numeric entries. In all cases however, when a numeric key is pressed the respective number appears in the right-most digit of the frequency display. Pressing another numeric key causes that number to be displayed and causes the previous number to shift one character to the left. Once the entire numeric entry is displayed, a terminator key is pressed to enter the new parameter into the receiver.

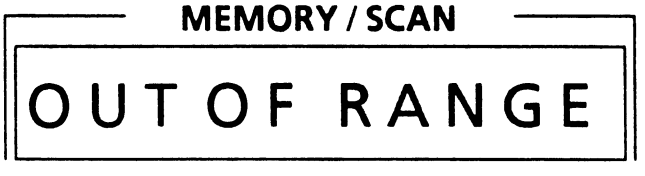
The following keys are valid terminator keys for numeric entries:

MHz key
kHz key
SQUELCH key
BFO key
BLANKER key
IF BW key
SPECIAL FUNCTION key
DWELL key
STEP SIZE key
CHANNEL VIEW key
SCAN SETUP key
FREQUENCY LOCKOUT key
CHANNEL STORE key
CHANNEL INCLUDE key
CHANNEL SKIP key
CHANNEL EXECUTE key

If any other key is pressed while an unterminated numeric entry is in progress, the Memory/Scan display on the front panel is overwritten and appears as follows:




indicating that the wrong terminator key was pressed for the numeric information that was displayed. If a numerical entry is out of the parameter range associated with the terminator key, the Memory/Scan display is overwritten and appears as follows:




indicating that the entry is out of range. All of the above messages will be displayed for three seconds. After that time the displays will return to display the information that was present before the invalid entry was made.

### C.2.7 THE kHz (KILOHERTZ) AND MHz (MEGAHERTZ) KEYS

The kHz and MHz keys can be used as terminators for numeric entries of the receiver tuned frequency. For example, to enter a tuned frequency of 0.050000 MHz (or 50 kHz), press the 5 key, then the 0 key, and then terminate the entry by pressing the kHz key. The same concept applies to the use of the MHz key.

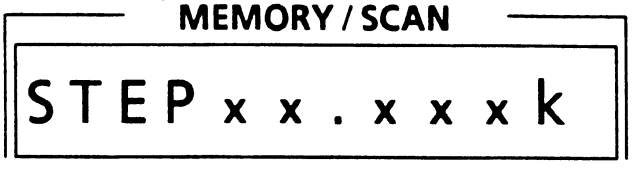
### C.2.8 THE CE (CLEAR ENTRY) KEY

The CE key can be used to clear an unwanted, in progress, numeric entry. This key is functional only when a numeric entry has already been started and a valid terminator key has not yet been pressed. Pressing the CE key causes the entire numeric entry to be erased.

### C.2.9 THE STEP TUNE KEY

The STEP TUNE key is used to place the front panel in the Step Tune mode. When in the Step Tune mode, the tuned frequency can be adjusted in steps that correspond to the step size previously set with the STEP SIZE key and indicated in the Memory/Scan display. (See **paragraph C.2.22** for details on setting the step size with the STEP SIZE key.)

When the Step Tune mode is entered, the LED in the STEP TUNE key is lit. If the TUNE LOCK key LED is lit when the Step Tune mode is entered, it is turned off. If the tuned frequency display has a highlighted digit (indicating decade tuning) when the Step Tune Mode is entered, the highlighting of that digit is discontinued. Also, when the Step Tune mode is entered, the STEP SIZE key LED in the Memory/Scan section is lit. The Memory/Scan display is overwritten and appears as follows:




where xx.xxx is the step size parameter value currently in effect. The most significant digit of this display is highlighted, when the Step Tune mode is entered, indicating that it can be adjusted. Therefore, entering the Step Tune mode automatically selects the step size parameter entry mode.

### C.2.10 THE AUXILIARY PARAMETER DISPLAYS

The Auxiliary Parameter section of the front panel contains two, 12-character alphanumeric displays. The upper display normally shows, from left to right, the gain control mode, the beat frequency oscillator (BFO) frequency, and the noise blanking interval. The lower display normally shows, from left to right, the IF bandwidth, the detection mode, and the squelch level.

### C.2.11 THE IF BW KEY AND LED

The IF BW key is located below the lower display in the Auxiliary Parameter section. This key is used to enter the receiver's IF bandwidth. The IF bandwidth entry mode is enabled when the IF BW key LED is lit. The currently selected IF bandwidth is displayed on the lower Auxiliary Parameter display. Each press of the IF BW key steps through the choices of IF bandwidths; 0.30, 1.00, 3.20, 6.00, and 16.0 kHz. If the current displayed IF bandwidth is 16.0 kHz, pressing the key again causes the 0.30 kHz IF bandwidth to be displayed. The IF bandwidth can also be adjusted with the Auxiliary Parameter edit knob when in the IF bandwidth entry mode. The IF bandwidth entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the IF BW key LED. When in LSB, USB, or ISB detection modes, the IF BW selection is limited to 3.20 kHz.

### C.2.12 THE DET MODE KEY AND LED

The DET MODE key is located below the lower display in the Auxiliary Parameter section. This key is used to enter the receiver's detection mode. The detection mode entry mode is enabled when the DET MODE key LED is lit. The current selected detection mode is displayed on the lower Auxiliary Parameter display. Each press of the DET MODE key steps through the choices of detection modes: AM, FM, CW, LSB, USB, and ISB. If the current displayed detection mode is ISB, pressing the key again causes the AM detection mode to be displayed. The detection mode can also be adjusted with the Auxiliary Parameter edit knob when in the detection mode entry mode. The detection mode entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the DET MODE key LED.

### C.2.13 THE SQUELCH KEY AND LED

The SQUELCH key is located below the lower display in the Auxiliary Parameter section. This key is used to allow the entry of the receiver's squelch level or to turn it off. The squelch parameter entry mode is enabled when the SQUELCH key LED is lit. The squelch parameter can be any value from 0 to -135 dBm or off. The squelch value is displayed in the lower Auxiliary Parameter display. (Note: The negative sign (-) is not displayed.) If the squelch parameter is a numeric value when the squelch parameter entry mode is enabled, the 10-dBm digit is highlighted indicating the entry resolution. Pressing the SQUELCH key again causes the 1-dBm digit to be highlighted. Pressing the key one more time causes "- - -" to be displayed meaning the squelch is off. Pressing the key while "- - -" is displayed causes the last entered numeric squelch parameter to be displayed, with the 10-dBm digit highlighted. The squelch value can be adjusted with the numeric entry keys or the Auxiliary Parameter edit knob (refer to **paragraph C.2.19**). The squelch parameter entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the SQUELCH LED.

### C.2.14 THE AGC KEY AND LED

The AGC key is located below the upper display in the Auxiliary Parameter section. This key is used to set the gain control mode of the receiver. When the gain control entry mode is active, the LED in the key is lit. The upper Auxiliary Parameter display shows the current gain control setting. Each press of the AGC key steps through the possible choices of FST (AGC fast), SLO (AGC slow), or manual gain. When manual gain is selected, the numeric gain value of 000 to 127 dB can be adjusted with the MANUAL GAIN knob (refer to paragraph 3.2.39). If the displayed mode is manual gain, pressing the key again causes FST to be displayed. The gain control mode can also be adjusted with the Auxiliary Parameter edit knob when in the gain control entry mode. The gain control entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the AGC LED.

### C.2.15 THE BFO KEY AND LED

When the CW detection mode is selected, a beat frequency oscillator (BFO) frequency can be entered. The BFO key is used to allow the entry of the BFO frequency. This key is located below the upper display in the Auxiliary Parameter section. When the BFO entry mode is enabled, the BFO key LED is lit. The current BFO frequency is displayed in the upper Auxiliary Parameter display. The BFO entry can be any frequency from +8000 to -8000 Hz. When the BFO entry mode is entered, the 1-kHz digit of the frequency is highlighted indicating the resolution. Each successive press of the BFO key causes the cursor to shift one digit to the right. If the cursor is present in the 10-Hz position when the key is pressed, the cursor wraps around to the 1-kHz digit. The BFO frequency can be entered with the Auxiliary Parameter edit

knob or the numeric entry keys. When numeric entry keys are used, pressing the BFO key terminates the numeric entry. The BFO entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the BFO key LED.

### C.2.16 THE +/- ZERO KEY

The +/- ZERO key is located below the upper display in the Auxiliary Parameter section. This key provides three functions to alter the BFO setting when the CW detection mode is selected. These functions are listed below.

- When pressed while the displayed BFO value is positive, it changes the BFO value to negative (-).
- When pressed while the displayed BFO value is negative, it changes the BFO value to zero (0000).
- When pressed while the displayed BFO value is zero (0000), it changes the BFO value to the absolute value of the last setting (either positive or negative).

### C.2.17 THE BLANKER KEY AND LED

The BLANKER key is located below the upper display of the Auxiliary Parameter section. This key is used to enable the entry of the noise blanker parameter for the receiver. The noise blanker parameter can be any value from 1 to 10 or can be set to off. The following are guidelines to remember when using the BLANKER key.

- The noise blanker entry mode is enabled when the BLANKER key LED is lit. The current noise blanker parameter is displayed in the far right area of the upper display in the Auxiliary Parameter section.
- When the noise blanker entry mode is enabled and the noise blanker parameter is a numeric value (not off), the 1's digit is highlighted to indicate resolution.
- Pressing the BLANKER key while a numeric noise blanker value is displayed causes " - -" to be displayed, meaning the noise blanker is off.
- Pressing the BLANKER key while " - -" is displayed causes the last recent numeric noise blanker value to be displayed.
- The BLANKER key is used as the numeric entry terminator when using the numeric entry keys to enter the noise blanker value.
- The higher the noise blanker value, the more the noise blanking is applied.

The noise blanker entry mode can be exited by pressing any other Auxiliary Parameter key.

### C.2.18 THE SPECIAL FUNCTION KEY AND LED

The SPECIAL FUNCTION key is located below the edit knob in the Auxiliary Parameter section. This key provides several functions as listed below:

- Selects the Passband Tuning mode (if in CW detection mode),
- Selects the BITE Initialization mode,
- Selects the Remote Control Selection mode,
- Selects the Remote Baud Rate Entry mode,
- Selects the Remote CSMA Address Entry Mode, and
- Terminates numeric entries in the Passband Tuning mode and the CSMA Address Entry mode.
- Displays the currently selected type of reference frequency (internal or external) and reference frequency (1, 2, 5, or 10 MHz) if external.

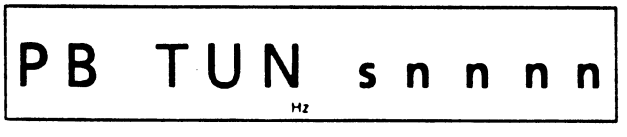
When any of the above functions are enabled, the SPECIAL FUNCTION key LED is lit. The following paragraphs provide more details on how to select the above functions with the SPECIAL FUNCTION key.

#### C.2.18.1 Selecting the Passband Tuning Mode with the SPECIAL FUNCTION Key

The Passband Tuning mode can be enabled by pressing the SPECIAL FUNCTION key while the CW detection mode is selected and one of the following conditions exist:

- The SPECIAL FUNCTION key LED is not lit, or
- The SPECIAL FUNCTION key LED is lit and the final Special Function menu item is displayed in the upper Auxiliary Parameter display.

When the Passband Tuning mode is enabled, the upper display appears as follows:




where "s" indicates the sign (+ or -) and "nnnn" represents the current Passband Tuning value in Hz. The 100-Hz digit is highlighted to indicate the resolution. The range of the Passband Tuning value is -2000 to +2000 Hz and can be adjusted with the Auxiliary Parameter edit knob. Pressing the SPECIAL FUNCTION key again highlights the 10-Hz digit, allowing the value to be adjusted in 10-Hz steps. The Passband Tuning value can also be entered with the numeric entry keys. When the numeric entry keys are used, pressing the SPECIAL FUNCTION key terminates the numeric entry.

C.2.18.2 **Selecting the BITE Initialization Mode with the SPECIAL FUNCTION Key**

The BITE (built-in-test) initialization mode can be enabled by pressing the SPECIAL FUNCTION key until the upper Auxiliary Parameter display appears as shown below.


If the Auxiliary Parameter edit knob is turned in either direction while the above message is displayed, all front panel LEDs are lit indicating that the receiver's built-in-test has been started. Refer to **paragraph C.5** for more details on the BITE function.

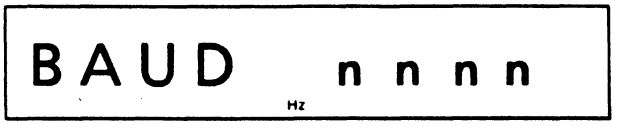
C.2.18.3 **Selecting the Remote Control Selection Mode with the SPECIAL FUNCTION Key**

The Remote Control Selection mode can be enabled by pressing the SPECIAL FUNCTION key until the upper Auxiliary Parameter display appears as follows:


Here, "xxxxx" is the current selected remote control mode, either "RS232" or " CSMA" . The Auxiliary Parameter edit knob can be used to change the selection. The selection is recognized by the receiver only after power is cycled off and back on. Refer to **paragraph C.6.1** for more details on selecting the remote control mode.

C.2.18.4 **Selecting the Remote Baud Rate Entry Mode with the SPECIAL FUNCTION Key**

The Remote Baud Rate Entry mode can be enabled by pressing the SPECIAL FUNCTION key until the upper Auxiliary Parameter display appears as follows:




Here, "nnnn" is the current selected baud rate. The Auxiliary Parameter edit knob can be used to select the baud rate. The selection is recognized by the receiver only after power is cycled off and back on.

If RS-232 remote control is selected (**paragraph C.2.18.3**), the above message is the final Special Function menu item. Pressing the SPECIAL FUNCTION key again causes the first available menu item to be redisplayed (either the Passband Tuning mode or the BITE mode). If CSMA remote control is selected, pressing the SPECIAL FUNCTION key again while the above message is displayed causes the CSMA Address Entry Mode to be selected (**paragraph C.2.18.5**).

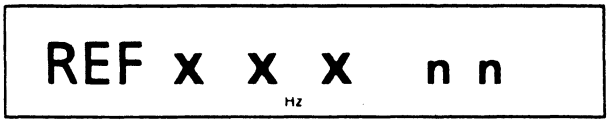
### C.2.18.5 Selecting the CSMA Address Mode with the SPECIAL FUNCTION Key

The CSMA Address Entry mode can be enabled by first selecting the CSMA remote control mode (see **paragraph C.2.18.3**) and then pressing the SPECIAL FUNCTION key until the upper Auxiliary Parameter display appears as follows:


Here, "nn" is the current setting of the CSMA address. The address can be entered with the Auxiliary Parameter edit knob (or numeric entry terminated with the SPECIAL FUNCTION key). Range of the address is 1 to 63 (0 is reserved). The selection is recognized by the receiver only after power is cycled off and back on. Pressing the SPECIAL FUNCTION key again causes the first available menu item to be redisplayed (either the Passband Tuning mode or the BITE mode).

### C.2.18.6 Displaying the Currently Selected Reference Frequency

The currently selected reference frequency can be displayed by pressing the SPECIAL FUNCTION key until the upper Auxiliary Parameter display appears as shown below.




Here, "xxx" is the currently selected type of reference frequency, either INT (internal) or EXT (external). When EXT is displayed, the "nn" is either 1, 2, 5, or 10. This number indicates the frequency, in MHz, of the currently applied external reference. When INT is displayed, the "nn" is blank (the internal reference frequency is always 10 MHz).

## C.2.19 THE AUXILIARY PARAMETER EDIT KNOB

The Auxiliary Parameter Edit knob is located just above the SPECIAL FUNCTION key in the Auxiliary Parameter section of the front panel. This knob can be used to alter various auxiliary parameters of the receiver when certain conditions are met. The following are the functions provided by the Auxiliary Parameter edit knob.

Gain Control: Scrolls up (clockwise) and down (counterclockwise) through gain control modes when the AGC key LED is lit (**paragraph C.2.14**). The available gain control modes are FST (AGC fast), SLO (AGC slow), and manual (numeric value), in that order.

BFO Frequency: Increases (clockwise) and decreases (counterclockwise) the BFO frequency value in steps corresponding to the highlighted digit of the BFO display when the BFO key LED is lit (**paragraph C.2.15**). The range of the BFO value is -8000 to +8000 Hz. Attempts to tune beyond these limits are ignored. The BFO value does not go directly from +8000 to -8000 Hz with a clockwise rotation of the edit knob (i.e. no wrap-around).

Noise Blanker: Increases (clockwise) and decreases (counterclockwise) the Noise Blanker value when the BLANKER key LED is lit (**paragraph C.2.17**). The range of the noise blanker value is 1 to 10 or " - -" (off). Attempts to tune beyond these limits are ignored. Turning the edit knob counterclockwise while 01 is displayed causes " - -" to be displayed. The noise blanker value does not go directly from 10 to " - -" with a clockwise rotation of the edit knob (i.e. no wrap-around).

IF Bandwidth: Scrolls up (clockwise) or scrolls down (counterclockwise) through the available IF bandwidths when the IF BW key LED is lit (**paragraph C.2.11**). The selectable IF bandwidths are 0.30, 1.00, 3.20, 6.00, and 16.0 kHz, in that order. The IF bandwidth selection does not go directly from 16.0 to 0.30 when the edit knob is turned clockwise, nor does it go directly from 0.30 to 16.0 when turned counterclockwise (i.e. no wrap-around).

Detection Mode: Scrolls up (clockwise) or scrolls down (counterclockwise) through the available detection modes when the DET MODE key LED is lit (**paragraph C.2.12**). The selectable detections modes are AM, FM, CW, LSB, USB, and ISB, in that order. The IF detection mode selection does not go directly from ISB to AM when the edit knob is turned clockwise, nor does it go directly from AM to ISB when turned counterclockwise (i.e. no wrap-around).

Squelch Level: Increases (clockwise) and decreases (counterclockwise) the squelch value in steps corresponding to the highlighted digit of the squelch parameter display when the SQUELCH key LED is lit (**paragraph C.2.13**). The range of the squelch parameter is 0 to -135 dBm or "- - -" (off). Turning the edit knob counterclockwise while 135 is displayed causes "- - -" to be displayed. Turning the edit knob counterclockwise while "- - -" is displayed has no effect. Turning the edit knob clockwise while "- - -" is displayed causes 135 to be displayed with the 10-dBm digit ("3") highlighted. Turning the knob clockwise while the maximum squelch parameter is displayed (000) does not directly step the parameter to the minimum value (-135 dBm) or "- - -".

Passband Tuning: Increases (clockwise) or decreases (counterclockwise) the passband tuning parameter in 100-Hz steps when the SPECIAL FUNCTION key LED is lit, the Passband Tuning mode is enabled, and the 100-Hz digit is highlighted in the passband tuning display (**paragraph C.2.18.1**). Increases (clockwise) or decreases (counterclockwise) the passband tuning parameter in 10-Hz steps when the 10-Hz digit is highlighted in the passband tuning display.

### C.2.20 THE MEMORY/SCAN SECTION ALPHANUMERIC DISPLAY

The Memory/Scan section of the front panel contains a 12-character alphanumeric display. This display provides information pertinent to the current setting of the Memory/Scan section controls.

### C.2.21 THE DWELL KEY AND LED

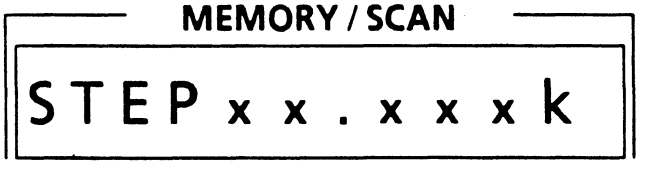
The DWELL key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key is used to enable the entry of dwell times for Scan operations. Pressing this key causes its LED to light and the dwell entry mode to be entered and displayed on the Memory/Scan display.

When the dwell entry mode is enabled, the current dwell value is shown on the display. The displayed dwell time can be any value from 0.5 to 20.0 seconds or can be infinite. If the current dwell value is numeric, the far left numeric digit is highlighted indicating resolution. Pressing the DWELL key again causes the cursor to shift one digit to the right. Pressing the DWELL key while the far right digit is highlighted causes "DWL INFINITE" to be displayed. If the key is pressed while "DWL INFINITE" is displayed, the last numeric dwell entry is redisplayed with the far left digit highlighted. The Memory/Scan edit knob can be used to adjust the highlighted value. The DWELL key is also used as a terminator key when using numeric entry keys to enter the dwell time.

### C.2.22 THE STEP SIZE KEY AND LED

The STEP SIZE key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key is used to enter the step size parameter entry mode. The step size parameter serves two functions: it defines the tuned frequency increment value when the STEP TUNE key LED is lit (**paragraph C.2.9**) and it defines the step size used in a frequency-to-frequency scan setup. The step size can also be adjusted by entering the scan setup menu with the SCAN SETUP key, **paragraph C.2.26**).

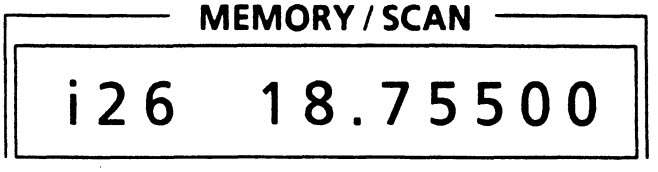
When the STEP SIZE key is pressed, its LED becomes lit and the alphanumeric display shows the current step size with the most significant (far left) digit highlighted indicating resolution. Below is an example of the alphanumeric display in the step size entry mode:




where xx.xxx is the current step size value in kHz. Pressing the key again causes the highlighted position to shift one digit to the right. Pressing the key while the least significant (far right) digit is highlighted causes the most significant digit to be highlighted. The STEP SIZE key can also be used as a terminator when using the numeric keys for entering the step size. This key is not functional while the receiver is actively scanning (i.e., the SCAN key LED is lit and the PAUSE key LED is not lit.

### C.2.23 THE CHANNEL VIEW KEY AND LED

The CHANNEL VIEW key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key is used to view the frequencies stored in the receiver's memory channels. The first press of the key causes the last viewed channel to be displayed in the Memory/Scan section alphanumeric display. The memory channel number is displayed prefixed with an "s" for skipped channels or an "i" for included channels. (Refer to **paragraph C.2.31** for details on using the CHANNEL SKIP key and to **paragraph C.2.30** for details on using the CHANNEL INCLUDE key.) The frequency stored in the current channel is also displayed in MHz, with 10-Hz resolution. The following is an example of the standard channel view display.




If the receiver is actively performing a Channel Scan, pressing the CHANNEL VIEW key causes "SCANNING XX" to be displayed where "XX" is the current channel to which the receiver is tuned ("XX" continuously changes as the receiver moves from channel to channel). If the receiver is dwelling or if the PAUSE key is pressed, the display reverts back to the standard channel view format showing the channel number and the corresponding stored frequency.

When the standard channel view format is displayed and an unterminated numeric entry is not in progress, pressing the CHANNEL VIEW key causes the next higher channel number and its frequency to be displayed. Valid channel numbers are from 00 to 99. Pressing the CHANNEL VIEW key while channel 99 is displayed causes channel 00 to be displayed. This key can also be used as a terminator after entering a channel number with the numeric entry keys.

### C.2.24 THE CHANNEL EXECUTE KEY AND LED

The CHANNEL EXECUTE key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key can be used to set the receiver to the parameter values stored in the displayed memory channel. If a memory channel is not visible in the alphanumeric display when the CHANNEL EXECUTE key is pressed, the Channel View mode is automatically entered, lighting the CHANNEL VIEW key LED. The receiver parameters stored in the displayed memory channel (including frequency, IF bandwidth, detection and gain modes, and squelch level) are immediately executed by the receiver. Because Channel View mode is active when the CHANNEL EXECUTE key is lit, the Memory/Scan edit knob or the CHANNEL VIEW key can be used to sequence through the stored memory channels, with the receiver executing each channel as it is displayed. Once entered, the Channel Execute mode can be exited by either pressing CHANNEL EXECUTE key again, by entering the Scan mode, or by altering a receiver parameter such that an exact match no longer exists between the displayed memory channel parameters and the receiver settings.

### C.2.25 THE SCAN TYPE KEY AND LEDS

The SCAN TYPE key is located in the Memory/Scan section of the front panel below the signal strength meter. Directly to the left of the key are three LED's. The LED that is lit indicates the selected scan type: CHANNEL for channel scan, F1 → F2 for start frequency to stop frequency scan, and F1 → F2 w/LOCK for start frequency to stop frequency scan with lockout frequencies bypassed. Each press of the key changes the scan type. The scan type currently selected, indicated by the lit LED, can be set up with the SCAN SETUP key (**paragraph C.2.26**).

### C.2.26 THE SCAN SETUP KEY AND LED

The SCAN SETUP key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key is used to set up a scan operation for the receiver. When the key is pressed, its LED lights indicating the scan setup mode is enabled, and the Memory/Scan section's alphanumeric display shows the first line of the scan setup menu. The scan setup menu displayed is dependent on the current scan type selected with the SCAN TYPE key, and indicated by the lit scan type LED. Each press of the SCAN SETUP key causes the next line of the scan type setup menu to be displayed. Pressing the SCAN SETUP key in succession while the CHANNEL scan type LED is lit causes the alphanumeric display to scroll through the following menu items:

START CHA XX (where XX is the current start channel)
STOP CHA XX (where XX is the current stop channel)
DWELL XX.X s (where XX.X is the current dwell time in seconds)
or
DWL INFINITE (when the dwell time is set to infinite)

Pressing the SCAN SETUP key in succession while the F1 → F2 scan type LED is lit causes the alphanumerics display to scroll through the following menu items:

F1 XX.XXXXXX (where XX.XXXXXX is the current start frequency in MHz)

F2 XX.XXXXXX (where XX.XXXXXX is the current stop frequency in MHz)

STEP XX.XXXk (where XX.XXX is the current step size frequency in kHz)

DWELL XX.X s (where XX.X is the current dwell time in seconds)

or

DWL INFINITE (when the dwell time is set to infinite)

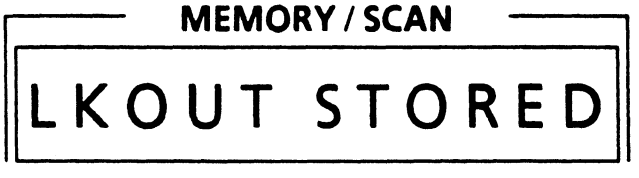
Pressing the SCAN SETUP key in succession while the F1 → F2 w/LOCK scan type LED is lit causes the alphanumeric display to scroll through the following menu items:

| | |
|---|---|
| F1 XX.XXXXXX | (where XX.XXXXXX is the current start frequency in MHz) |
| F2 XX.XXXXXX | (where XX.XXXXXX is the current stop frequency in MHz) |
| STEP XX.XXXk | (where XX.XXX is the current step size frequency in kHz) |
| DWELL XX.X s | (where XX.X is the current dwell time) |
| or | |
| DWL INFINITE | (when the dwell time is set to infinite) |
| Lk XX.XXXXXX | (where XX.XXXXXX is the lowest lockout frequency in MHz) |
| | (each key press scrolls through the entered lockout frequencies in frequency-numeric order between F1 and F2) |
| Lk XX.XXXXXX | (where XX.XXXXXX is the highest lockout frequency in MHz) |

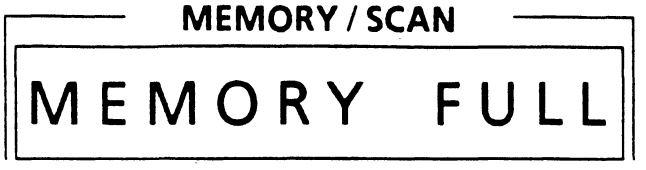
After completely scrolling through the scan setup menu, pressing the SCAN SETUP key again exits the scan setup mode. This key can also be used as numeric entry terminator when using the numeric entry keys to enter scan setup parameters. Using the key as a terminator causes the new value to appear in the Memory/Scan alphanumeric display for a period of three seconds, after which time the display automatically increments to the next menu item.

### C.2.27 THE FREQUENCY LOCKOUT KEY

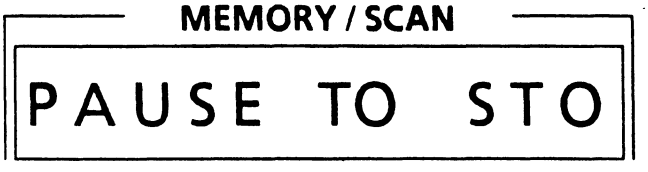
The FREQUENCY LOCKOUT key is located directly below the SCAN SETUP key in the Memory/Scan section of the front panel. The key is used to store the current receiver tuned frequency and selected IF bandwidth in one of the lockout memory locations of the receiver. Up to 100 lockout frequencies can be entered. When the FREQUENCY LOCKOUT key is pressed, the Memory/Scan alphanumeric display appears as shown below for one second.



After one second the display returns to its previous state. If an attempt is made to enter a new lockout frequency when 100 lockout frequencies are already entered, the following message is temporarily displayed:




indicating the lockout memory is full. Lockout frequencies cannot be entered with the FREQUENCY LOCKOUT key while the receiver is actively scanning. An attempt to enter a lockout frequency while the receiver is actively scanning causes the following message to be displayed for three seconds:




which indicates the scan must be paused before the lockout frequency can be entered.

### C.2.28 THE CHANNEL STORE KEY

The CHANNEL STORE key is located below the edit knob in the Memory/Scan section of the front panel. This key is used to enter receiver parameters into one of the memory channels. If not currently in the channel view mode, the first press of the key causes the channel view mode to be entered (see **paragraph C.2.23**) and the channel that was last stored or viewed to be shown on the Memory/Scan section alphanumeric display. Once the channel view mode is enabled, pressing the CHANNEL STORE key causes the receiver parameters to be stored in the displayed memory channel, overwriting the previous data for that memory channel. The stored parameters are tuned frequency, gain mode, IF bandwidth, detection mode, and squelch level.

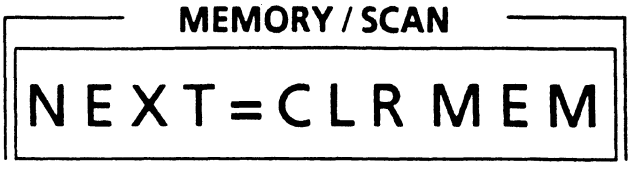
### C.2.29 THE CLEAR KEY

**NOTE**

The CLEAR key can be used to clear all lockout and channel memory. Read the following paragraphs carefully to avoid accidental deletion of stored scan parameters.

The CLEAR key is located directly below the CHANNEL STORE key in the Memory/Scan section of the front panel. This key serves several functions as listed below.

- Pressing this key while a lockout frequency is displayed in the the scan setup mode (**paragraphs C.2.26** and **C.2.27**), causes the displayed frequency to be cleared from the lockout memory.
- Pressing this key while a lockout frequency is not displayed causes the current Memory/Scan section entry mode to be exited and the alphanumeric display to be cleared.
- Pressing this key twice while a lockout frequency is not displayed causes the following message to be displayed on the alphanumeric display.




- Pressing the CLEAR key while the above message is displayed clears the contents of all lockout and memory channels and causes "MEM CLEARED" to be displayed.
- Pressing the CLEAR key three times in succession (while a lockout frequency is not displayed) clears the contents of all lockout and memory channels.

### C.2.30 THE CHANNEL INCLUDE KEY

The CHANNEL INCLUDE key is located below the edit knob in the Memory/Scan section of the front panel. Pressing this key forces the receiver into the channel view mode if not already entered. Pressing this key while in the channel view mode places the displayed channel in the "include" status. This means that when the receiver is scanning in the channel scan mode, the channel will be visited as long as it is within the start and stop channels. A channel set to the "include" status is indicated by an "i" located to the left of the channel number in the alphanumeric display. After setting a channel to the "include" status with the CHANNEL INCLUDE key, the new prefix appears in the display for three seconds. The display then automatically increments to the next higher channel number.

To place a channel in include status, enter the channel number with the numeric entry keys, and terminate the entry with the CHANNEL INCLUDE key. Groups of successive channels can be set to the "include" status by entering the lowest channel number of the group, a decimal point, and the highest channel number of the group, and terminating with the CHANNEL INCLUDE key. This action causes the display to show the highest channel number of the group prefixed with an "i" for three seconds, then automatically increments to the next higher channel number.

### C.2.34 THE MEMORY/SCAN PARAMETERS EDIT KNOB

The Memory/Scan parameters edit knob is located below the STEP SIZE and CHANNEL VIEW keys in the Memory/Scan section of the front panel. This knob can be used to alter various Memory/Scan parameters of the receiver when certain restrictions are met. The following are the functions provided by the Memory/Scan parameter edit knob.

Dwell Timer: Increments (clockwise) or decrements (counterclockwise) the dwell timer parameter in steps corresponding to the highlighted digit of the dwell timer display when the DWELL key LED is lit (**paragraph C.2.21**). The range of the dwell timer value is 0.5 to 20.0 seconds or can be set to INFINITE. The dwell time parameter does not go directly from DWL INFINITE to 0.5 seconds with a clockwise rotation of the edit knob (i.e., no wrap-around).

Step Size: Increments (clockwise) or decrements (counterclockwise) the step size parameter in steps corresponding to the highlighted digit of the step size display when the STEP SIZE key LED is lit (**paragraph C.2.22**). The range of the step size parameter is 0.001 to 25.0 kHz. The step size parameter does not go directly from 25.0 to 0.001 with a clockwise rotation of the edit knob (i.e., no wrap-around).

Channel Number: Increments (clockwise) or decrements (counterclockwise) the channel number in the channel view mode when the CHANNEL VIEW key LED is lit (**paragraph C.2.23**). The range of channel numbers is 00 to 99. Rotating the edit knob clockwise while channel number 99 is displayed causes channel number 00 to be displayed and rotating counterclockwise while 00 is displayed causes 99 to be displayed (i.e., wrap-around).

Scan Setup: Rotating the edit knob clockwise or counterclockwise scrolls up or down through the scan setup menu, respectively, when the SCAN SETUP key LED is lit (**paragraph C.2.26**).

### C.2.35 THE PHONES OUTPUT VOLUME CONTROL KNOB

The PHONES output volume control knob is located to the right of the PHONES jack on the bottom left-hand corner of the front panel. This knob is used to increase or decrease the volume level of the audio output on both channels of the PHONES jack. A clockwise rotation increases the volume of a nominal audio signal up to approximately 10 milliwatts and a counterclockwise rotation decreases the volume to approximately 0 milliwatt. This control is also operational while the receiver is in remote mode.

### C.2.36 THE SPEAKER KEY AND LEDS

The SPEAKER key is located to the right of the PHONES output volume control knob. This key is used to select the audio to be applied to the speaker outputs on pins 7 and 8 of audio terminal block TB1, located on the rear panel, when the ISB (independent sideband) detection mode is selected. Each press of the key toggles through the available selections of USB (upper sideband), BOTH, and LSB (lower sideband), lighting the appropriate LED to the left of the key.

When USB is selected, only upper sideband audio is provided at the speaker output. When BOTH is selected, upper sideband and lower sideband audio are provided at the speaker output. When LSB is selected, only lower sideband audio is provided at the speaker output. This key has no effect on the speaker output when any detection mode other than ISB is selected.

The SPEAKER key also controls the audio available at the optional internal speaker when installed.

### C.2.37 THE SPEAKER OUTPUT VOLUME CONTROL KNOB

The SPEAKER output volume control knob is located to the right of the SPEAKER key on the front panel. This knob is used to increase or decrease the volume level of the audio signal present at the speaker output on pins 7 an 8 of terminal strip TB1 located on the rear panel. A clockwise rotation increases the volume of a nominal audio signal, up to approximately 1 watt. A counterclockwise rotation decreases the volume, down to approximately 0 milliwatts. This control is operational while the receiver is in remote mode. It also is used to control the volume at the optional internal speaker when installed.

### C.2.38 THE RF INPUT KEY

The RF INPUT key is located to the right of the SPEAKER volume control knob on the front panel. This key is used to select the path of the input RF signal, prior to being applied to any IF conversions. Each press of the key toggles through the available selections of PREAMP (preamplifier), ATTN (attenuator), or NORM (normal: neither amplified or attenuated).

Preamplifier is selected when the PREAMP LED is lit. In this selection, the input RF signal is amplified approximately 10 dB. The attenuator is selected when the ATTN LED is lit. In this selection, the RF signal is attenuated approximately 15 dB. When the NORM LED is lit, the input signal is routed in its normal path to the other circuits of the receiver.

The PREAMP selection is disabled when the receiver is tuned at or below 500 kHz. If PREAMP is selected while tuned above 500 kHz and then the receiver is tuned below 500 kHz, the preamplifier path is automatically deselected (PREAMP LED goes out) and the normal input path is automatically selected (NORM LED becomes lit). If the receiver is then tuned back above 500 kHz, the normal path is deselected (NORM LED goes out) and the preamplifier path is reselected (PREAMP LED becomes lit).

### C.2.39 THE MANUAL GAIN CONTROL KNOB

The MANUAL GAIN control knob is located to the right of the RF INPUT key on the front panel. This control knob is used to adjust the manual gain of the receiver when the manual gain control is selected with the AGC key and the numerical gain value is displayed in the upper display of the Auxiliary Parameter section (refer to **paragraph C.2.14**).

The manual gain range is from 0 to 127 dB. When this knob is set at its full counterclockwise position, minimum gain is applied to the input signal as 000 is displayed. Rotating the knob clockwise increases the gain. A full clockwise position of this knob displays 127 as the gain value and applies approximately maximum gain to the input signal.

### C.2.40 THE SIGNAL LEVEL METER

The signal level meter is located between the Memory/Scan section and the Auxiliary Parameter section on the front panel. This meter provides an indication of the power level of the signal at the current tuned frequency. The range of the meter is from -120 to +10 dBm. It should be noted that the indication on the meter is a measurement of the input signal level before attenuation or amplification is applied via the RF INPUT key.

### C.2.41 THE REMOTE KEY AND LED

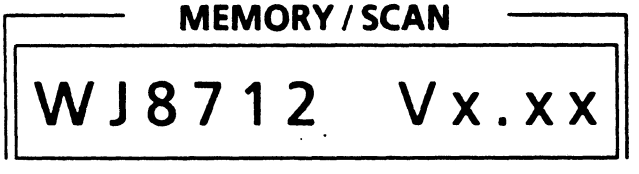
The REMOTE key is located below the POWER switch on the top left-hand corner of the front panel. This key is used to place the receiver in and out of Remote mode of operation. The LED in the key is lit when the receiver is in remote mode. While in the Remote mode, all front panel controls are disabled except for the REMOTE key, the PHONES and SPEAKER volume control knobs, and the POWER switch. Pressing the key while the LED is lit places the receiver in Local mode and extinguishes the LED (if remote with local lockout has not been selected over the remote bus).

### C.2.42 THE POWER SWITCH

The POWER switch is a rocker-type switch located on the top left-hand corner of the front panel. This switch is not functional for the test operation.

## C.3 TURNING ON THE RECEIVER AND THE FRONT PANEL

The WJ-8712 receiver and the TF-30387 Front Panel Interface are turned on when the top-half of the WJ-8712 POWER switch is pushed in. From the off state, turning the receiver on causes it to go into its power-up and initialization routine. During initialization, the receiver lights all front panel lights with the exception of the Memory/Scan display. This display, shown below, provides the unit and the software version (Vx.xx). The Memory/Scan display performs this in receivers with internal control software versions 1.40 and later only.




After approximately one second, initialization is complete, and the receiver automatically returns to the last selected mode, displaying the last set parameters.

The WJ-8712 is equipped with battery backed-up memory. When the receiver is turned off, all current receiver parameters (including channel set-ups) are saved in memory. When the receiver is powered up, the receiver parameters that were set and displayed, prior to the receiver being turned off, are reset in the receiver and redisplayed on the displays as applicable.

### C.3.1 PERFORMING A COLD START AT POWER-UP

**NOTE**

When a cold start is performed at power-up, all setups in memory are cleared. All scan setups, memory channel contents, and receiver parameters are reset to their default conditions.

The receiver can be cycled through a cold start at power-up. A cold start provides a means of clearing the receiver of all previous settings saved in memory and possible front panel errors. This is performed by pressing and holding the CE (clear entry) key while turning on the receiver, then releasing the CE key. At cold start power-up the MEMORY SCAN display shows "COLD START" for approximately two seconds while clearing memory then goes through its normal initialization routine. When the power-up routine is completed, the auxiliary parameter displays and the tuned frequency window displays their default settings.

## C.4 RUNNING THE BUILT-IN-TEST FUNCTION (BITE)

The built-in-test function (BITE) provides the operator the capability of testing the internal circuitry of the receiver. A passed BITE test provides confidence that the receiver is performing normally.

To start BITE, first press the SPECIAL FUNCTION key until the message "BITE PENDING" is shown in the upper Auxiliary Parameter display. Then turn the Auxiliary Parameter edit knob in either direction; all LEDs are lit while BITE is being run.

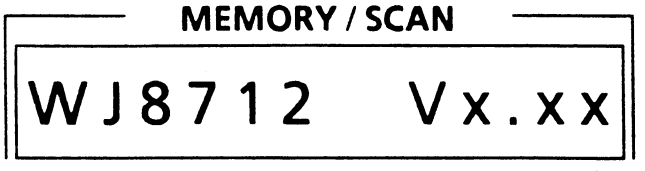
The BITE result takes the form of a decimal number, equivalent to a 16-bit binary number. Sixteen tests are performed during the BITE routine. A failed test sets its corresponding bit in a 16-bit register table. The tests and their corresponding bits of the register table are listed in **Table C-1.**

**Table C-1. BITE Error Codes**

| Bit | Decimal Value | Error Indication |
|---|---|---|
| 0 (LSB) | 1 | **Transmit Error** - the control to DSP transmit pipeline is not empty. |
| 1 | 2 | **Host Download Unsuccessful** - the host microprocessor could not download the operating program. |
| 2 | 4 | **EPROM Download Unsuccessful** - the download to EPROM could not be completed. |
| 3 | 8 | **Host Command Not Acknowledged** - the DSP processor could not acknowledge the start-up command from the host microprocessor. |

## C.5 DISPLAYING THE RECEIVER'S CURRENT INTERNAL CONTROL SOFTWARE VERSION

To display the receiver's current internal control software version turn the POWER switch off and then on. The receiver goes through its initialization routine and displays the unit's current internal control software version in the Memory/Scan display. The internal control software version is displayed for approximately one second. The Vx.xx indicates the current software version.




This function is only available in units with internal control software version 1.40 and later.

## C.6 SETTING REMOTE OPERATION CONFIGURATIONS FROM THE FRONT PANEL

From the front panel the local operator can select several remote operation configurations: RS-232 or CSMA remote operation selection, baud rate selection, and receiver address selection for CSMA remote operation. The following paragraphs provide details on performing these configurations.

**NOTE**

The receiver only recognizes remote configuration changes when power is cycled off and back on. After making any remote configuration changes, turn the receiver off then back on to set the new configuration in the receiver.

### C.6.1 SELECTING THE RS-232 OR THE CSMA INTERFACE FOR REMOTE OPERATIONS

The interface to be used for receiver remote operation can be selected from the front panel by pressing the SPECIAL FUNCTION key until the message "REMOTE xxxxx" is displayed in the upper Auxiliary Parameter display. The xxxxx is replaced with the current selection, either "RS232" or "CSMA". Use the Auxiliary Parameter edit knob to display the desired remote interface. This selection overrides the selection made with DIP switch A2S1 (see **Section II**). Refer to **Section IV** of this manual for details on RS-232 remote operations or to **Section V** for details on CSMA remote operations.

### C.6.2 SELECTING THE BAUD RATE FOR REMOTE OPERATIONS

The baud rate for RS-232 and CSMA remote operations can be selected from the front panel by pressing the SPECIAL FUNCTION key until the message "BAUD xxxx" is displayed in the upper Auxiliary Parameter display. The available baud rates are 75, 150, 300, 600, 1200, 2400, 4800, and 9600 bps. Use the Auxiliary Parameter edit knob to display the desired baud rate. The baud rate selected applies to both RS-232 and CSMA remote operations (separate baud rate selections are not available). This selection overrides the selection made with DIP switch A2S1 (see **Section II**).

### C.6.3 SELECTING THE RECEIVER'S ADDRESS FOR CSMA REMOTE OPERATIONS

The address of the receiver for CSMA remote operations can be selected at the front panel by pressing the SPECIAL FUNCTION key until the message "ADDRESS xx" is displayed in the upper Auxiliary Parameter display. The "xx" is replaced with the current address selection. The CSMA address selection is available only while CSMA is selected for remote operations (refer to **paragraph C.6.1**).

The CSMA address for the receiver can be any number from 1 to 63 (0 is reserved). Use the Auxiliary Parameter edit knob to select and display the desired address number. This selection overrides the selection made with DIP switch A2S2 (see **Section II**).